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ELECTRICAL REVIEW

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1 JANUARY 1954

In This Issue

1 A MEMORABLE YEAR
3 LITTLEBROOK
12 THE GENERAL VECTOR DIAGRAM
16 OVERSEAS ELECTRICAL TRADE
17 EXTERNAL TRADE CLASSIFICATION
19 FUEL EFFICIENCY
20 CAR FERRY TERMINAL
22 MATERIALS FOR THE ELECTRICAL INDUSTRY
25 VIEWS ON THE NEWS
26 PERSONAL AND SOCIAL
29 LETTERS TO THE EDITOR
31 INDUSTRIAL NEWS
34 NEW ELECTRICAL EQUIPMENT
35 GENERATION AND DEVELOPMENT
37 ELECTRICAL MANUFACTURING—1953
39 ENGINEERING IN EUROPE
40 FINANCIAL SECTION
43 NEW PATENTS
44 NEXT WEEK'S EVENTS
45 CONTRACT INFORMATION
105 CLASSIFIED ADVERTISEMENTS
113 REGIONAL GUIDE TO ELECTRICAL CONTRACTORS
116 INDEX TO ADVERTISERS

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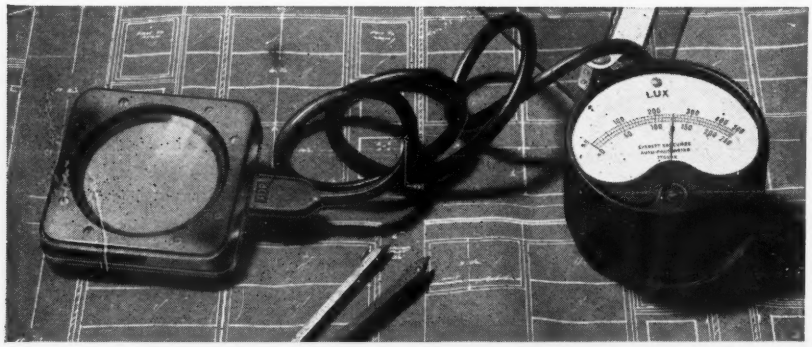

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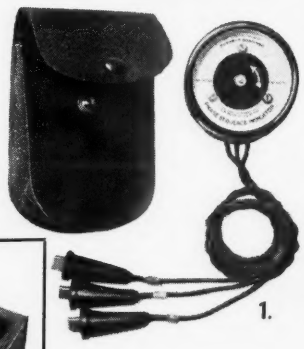

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ELECTRICAL REVIEW

1 January 1954 Vol. 154 No. 1 Established 1872

A Memorable Year

MANY occasions combined to make 1953 a year of unusual electrical importance. Outstanding among the events recorded in our columns was, of course, the Coronation when the dramatic effect of sound and television broadcasts at the ceremony itself was prolonged by the subsequent illuminations, which demonstrated the advances still being made in the oldest common application of electricity. The even older use of cables for communications received a new lease of life by the decision taken only a few weeks ago to lay the first telephone, as distinct from telegraph, cable across the Atlantic. On the heavy power side the putting into service last July of a section of the super-grid marked a notable advance in transmission, with all that this implies in the provision of transformers, switchgear, and cables for 275 kV. Another possible step forward was presaged in the tests made to ascertain the feasibility of a 132 kV link with the French high-voltage system, the most ambitious underwater project in the world.

Further hydro-electric developments in the Highlands of Scotland, the conclusion of successful tests on a wind-power turbine, the initiation of work on a pumped storage scheme as a means of meeting peak demands were representative of activities under-taken to supplement the functions of coal-fired power stations. By taking preliminary steps towards building a power station to use combustible waste from collieries the B.E.A. will increase the secondary service rendered by public electricity supply in providing an indispensable market for low-grade coals. Of more immediate practical importance is it that the capacity of steam plant installed in 1953 was of the same order as in 1952, showing that the previous year's record was no mere flash in the pan.

Taking a long view it may well be, for reasons given here last week, that the preparation last spring of the site for a nuclear power station represents the small beginning of a new epoch in generation. The railways presented a good illustration of progress in utilization during the past year in their plans for electrifying the London to Southend line. There was also the completion of the experimental conversion of the Lancaster–Morecambe–Heysham line to 50 c/s single-phase working. To cite a few features of last year's progress that possess more obvious utility is not to be unmindful of possible results from research that are still in embryonic form but may have far-reaching potentialities. What use, for instance, can be made of the trapping of electrons in the United States to be released here, as Dr. L. G. Brazier did last October? The only answer seems to be that given by Faraday with regard to his discovery of the principle of electro-magnetic induction: "What is the use of a new-born baby?"

GROUP GENERATION

Under the existing divisional organization of the British Electricity Authority group operation of power stations is now accepted practice. But it is unusual to find more than two power stations on one site operating as a single generating unit, as in the case of the three stations at Littlebrook, near Dartford, Kent, of the South Eastern Division of the B.E.A., which we describe in the following pages. Although there are services common to all three of the stations in this 480 MW group—electrical, coal handling, circulating water, etc.—the stations are all designed for, and operated on, different loading characteristics, including base-load running in station " B," which is the station which won first place in the B.E.A. list of thermal efficiencies (29·5 per cent) for 1952. By means of temperature-entropy diagrams we have attempted to give approximate economic interpretations of the three methods of operation of the stations and, as would be expected, the heat cycle and other losses for station " B," with its higher initial steam conditions of 1,310 lb/sq in and 850 deg F and the adoption of re-heating to the initial temperature, are considerably lower than in either of the other two stations. In point of fact the total heat losses (cycle and others) per kWh generated are reduced to 7,775 B.Th.U. from the corresponding figure of 10,236 for station " A " which is two-shift operated. Such a comparative analysis, of course, cannot have its full meaning without taking into consideration capital costs, but with stations like those at Littlebrook, built at different times during the long post-war period of steeply rising costs, such a consideration would be rather speculative, and we feel that the economic differences for the various load characteristics can be sufficiently well appreciated without reference to constructional costs.

AIRCRAFT WIRING

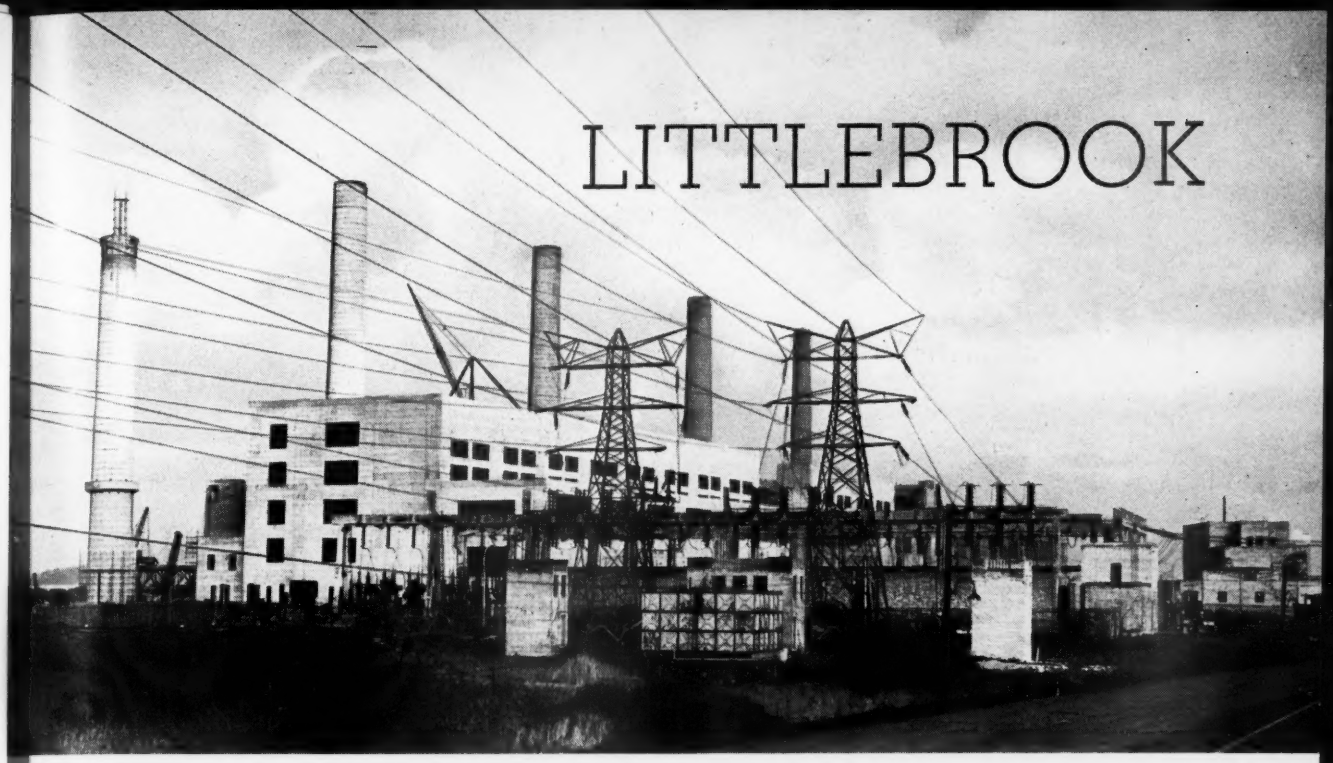
We are deeply concerned about the statement reported in the lay Press to have been made recently by Mr. B. S. Shenstone, chief engineer of the British European Airways Corporation, to the effect that the whole of the electrical wiring of an exported British aircraft had had to be renewed because of its poor condition. Mr. Shenstone does not appear to have indicated in any way whether it is a fact or whether it is his opinion that this lamentable incident was an isolated case or whether it represented a general state of affairs. In the world's engineering markets the degree of production perfection attained by British aircraft manufacturers has gained an invaluable reputation, especially electrically. Therefore such a criticism from so authoritative a quarter may be most damaging to British industry and in particular to the British electrical manufacturing industry. We do not for one moment condemn Mr. Shenstone's statement without reserve. If what he has said reflects to any extent truly on the electrical industry, then we welcome his criticism as one which is bound to do a lot of good because the industry will be forced to look into it. Mr. Shenstone does not appear to have made it clear whether he was referring to materials, to workmanship or to both, but in any case we must conclude our remarks with some of our personal observations. We have visited over many years numerous aero-engine and aircraft factories throughout this country, and on these visits we have never once failed to be most favourably impressed by the high quality of both electrical materials and workmanship put into the aircraft, and this applies particularly to the more modern methods of wiring to jigs and templates. Moreover, the assemblies are subjected to exacting tests before being put into service.

CHARGES ON ELECTRONS

Dr. Robert A. Millikan, whose death has occurred at his home in California at the age of eighty-five, will no doubt be best remembered for his research work in connection with the electric charges on electrons. By observations of the behaviour of free electrons which were occasionally caught by drops of oil in a fine spray created between two electrically charged plates in a tube, and by calculating the weights of uncharged and charged drops, he was able to show, by virtue of knowing the voltage on the plates, that the force on a charged oil drop was always of the same size or of a multiple of this size. This proved that the charges on all electrons were of equal size, the multiple values indicating the capture of a number of electrons simultaneously. Thus Millikan determined both the absolute value of the charge of an electron and that all electrons were alike. It was chiefly for this work that he received the Nobel Prize for Physics in 1923. Further researches by Dr. Millikan related to spectra and cosmic rays. By using very powerful electric sparks for producing the spectra in the region between the shortest ultra-violet rays and the longest X-rays much valuable physical data were collected. In 1949 President Truman gave Dr. Millikan the Presidential Medal of Merit " for exceptionally meritorious conduct in the performance of outstanding services to the U.S.A." during the war. Millikan joined the staff of Chicago University in 1896, becoming professor there in 1910. In 1921 he was appointed director of the Norman Bridge Laboratory of Physics and chairman of the executive council of the new California Institute of Technology at Pasadena where he made his home, retiring in 1945.

DOMESTIC APPLIANCE PRODUCTION

Endeavours by the Dominions to produce their own electrical equipment have had an adverse effect upon overseas sales of United Kingdom domestic electrical appliances. The native manufacturers have been greatly assisted by import restrictions and we have shown from time to time how their business has expanded—even to the extent, in the case of Australia, of enabling them to export appliances. Figures from New Zealand show that in 1951–52 there was a further advance, particularly in the production of washing machines, refrigerators and radio sets. United Kingdom producers can still, however, claim some share of the Dominion trade and the expected broadening of our own home market should have a favourable effect upon export prices. It must be remembered, however, that quality is probably the most potent sales factor.



LITTLEBROOK

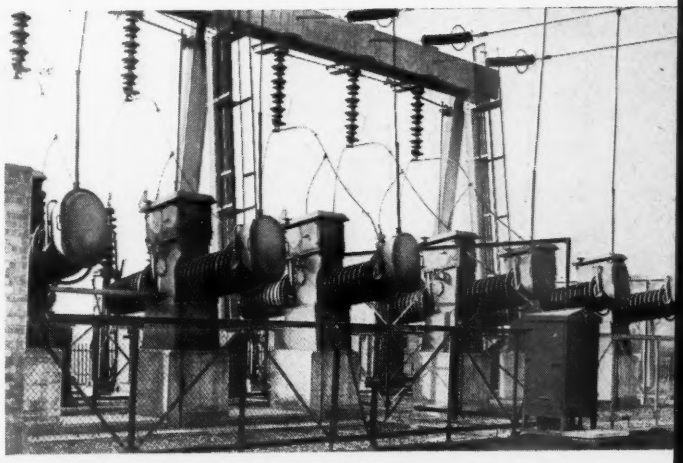
Generation by Three Power Stations to Suit Different Load Characteristics

WE have selected for the purpose of this article the group of power stations of the British Electricity Authority, South Eastern Division, known as Littlebrook "A," "B" and "C" stations, near Dartford, Kent, because of their outstanding interest, operationally at any rate, in that although the three stations constitute a single generating unit, with a sectionalized common supply to the grid, each station is designed for and is operated on different loading conditions. There is the added point of interest, of course, that Littlebrook "B" headed the efficiency list of the B.E.A. stations for 1952 with a thermal efficiency of 29·95 per cent.

Littlebrook "A," which has a total generating plant capacity of 120 MW, was put into commission in 1939 with one 30 MW set, and was completed in 1940; it operates as a two-shift station. Littlebrook "B" has a capacity of 120 MW. The first 60 MW set began operation in 1949 and the second in 1950; it is employed as a base-load station. Littlebrook "C," which will eventually have a total generating plant capacity of 240 MW, was commissioned with a 60 MW set in 1952. The present plant capacity is 180 MW (the third 60 MW set having just been commissioned) and it operates with the maximum flexibility as a station with characteristics between those of a base-load station and a two-shift station.

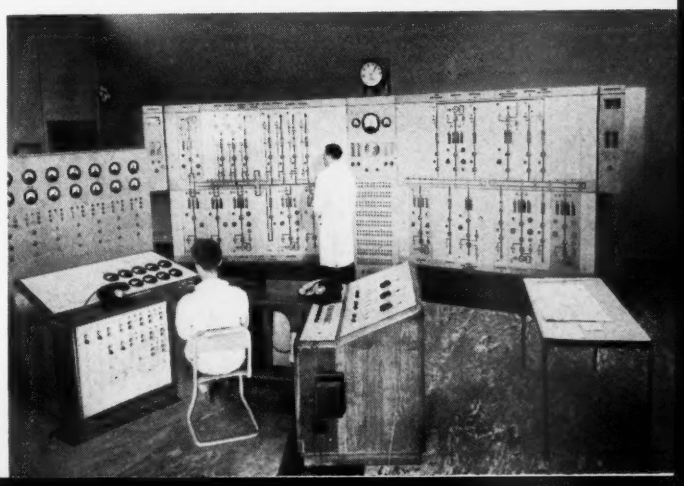
The first design and operation reflection of these different conditions is found in the different heat cycles of the stations. The terminal steam conditions at the boiler stop valves are: Littlebrook "A," 625 lb/sq in and 825 deg F; Littlebrook "B," 1,310 lb/sq in and 850 deg F; Littlebrook "C," 975 lb/sq in and 915 deg F.

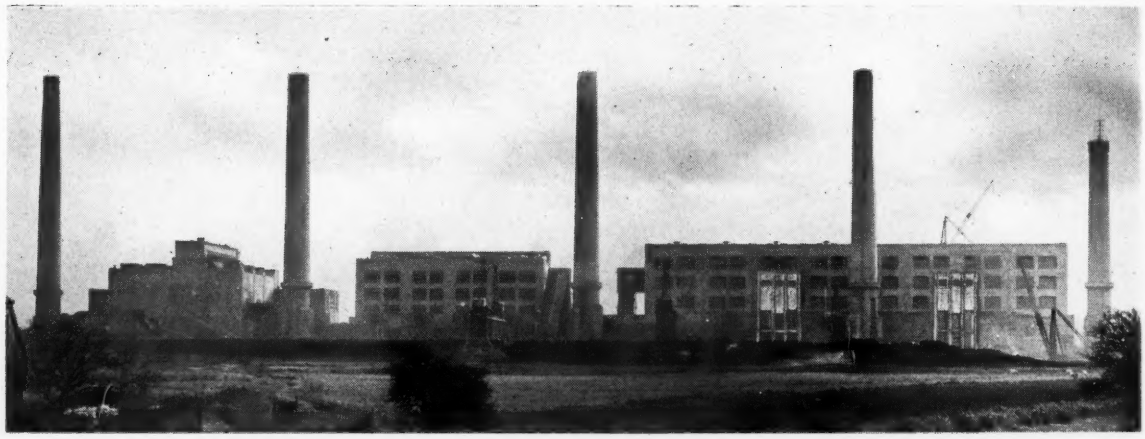
Fig. 1 on the next page shows three temperature-entropy diagrams of the most simple character. The diagrams have been drawn to show the quantities involved in the production of 1 kWh. In the case of the "B" station the cycle loss has been reduced to 3,519 B.Th.U. and the



The 132 kV circuit breakers are outdoor equipments

Main control room situated near the 66 kV switchgear houses





The " A " " B " and " C " station buildings are entirely separate structures

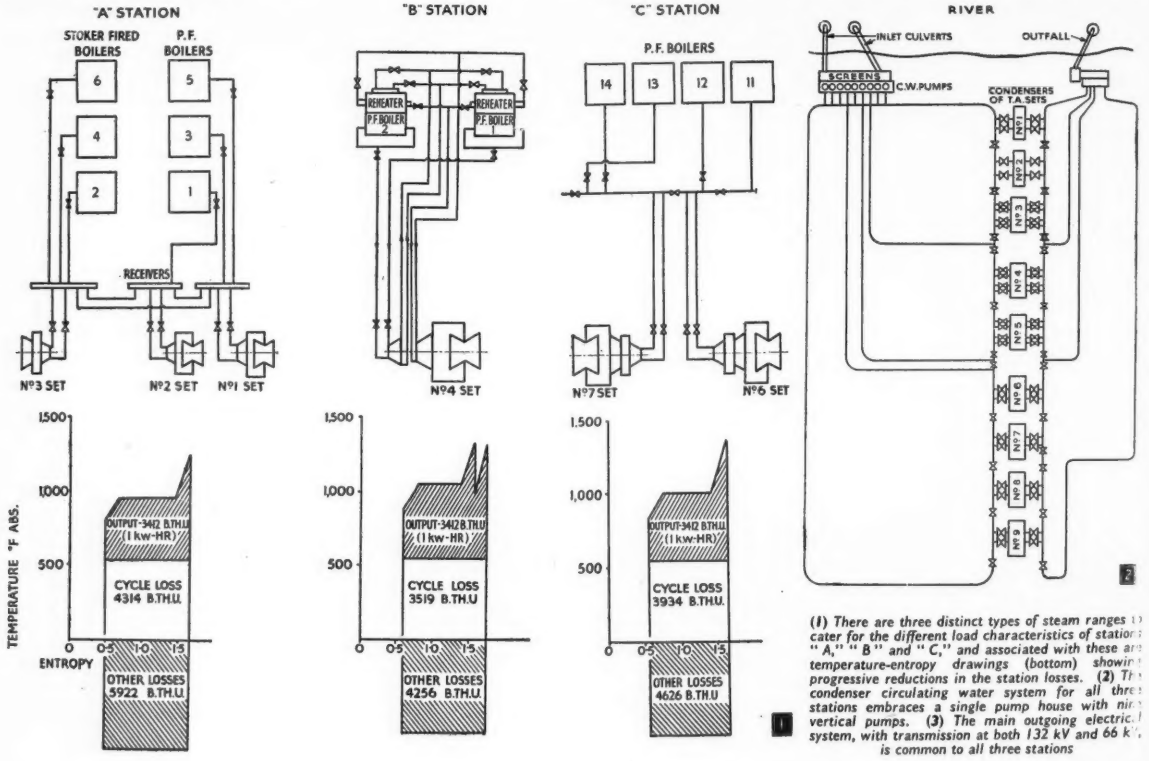
other losses reduced to 4,256 B.Th.U., compared with 4,314 B.Th.U. and 5,922 B.Th.U., respectively, for the " A " station. " C " station losses are shown to be less than those of " A," but not so low as " B " station losses.

Referring to the associated diagram of the main steam ranges (Fig. 1), there are three distinct types. In the case of station " A " the boiler outlets are connected into three interconnected steam receivers. In the case of the " B " station there are two boilers serving each turbo-alternator set, connected in the unit system. In the case of the " C " station all the boilers and turbines are interconnected through a common steam manifold.

The services common to the three stations are the 132 kV and 66 kV outgoing electrical systems, together with the interconnection of the 6 kV unit and station switchboards; the condenser circulating water system; the coal handling plant; and the ash disposal area.

When the " C " station is completed there will in all be two 60 MW sets and two 30 MW sets connected through step-up transformers to the 66 kV busbars and five 60 MW generators connected via step-up transformers to the 132 kV busbars. The 66 kV switchgear is of the Reyrolle indoor metalclad pneumatic oil operated oil immersed type, and the 132 kV switchgear is of the Metrovick pneumatic operated oil immersed impulse type. Both of these classes of switchgear have a rupturing capacity of 2,000 MVA. The 66 kV switchgear is segregated in two switch houses, one each side of the site access road, with oil filled cable interconnections. The 132 kV switchgear is also in two sections with overhead busbar crossing the road. The control for all three stations is grouped in a central operating room near the 66 kV switch house.

The unit transformer principle of auxiliary supply has been adopted as best ensuring the reliability of the auxiliary



(1) There are three distinct types of steam ranges to cater for the different load characteristics of stations " A," " B " and " C," and associated with these are temperature-entropy drawings (bottom) showing progressive reductions in the station losses. (2) The condenser circulating water system for all three stations embraces a single pump house with nine vertical pumps. (3) The main outgoing electrical system, with transmission at both 132 kV and 66 kV, is common to all three stations

services; each unit transformer giving supply to the essential auxiliaries directly associated with the boilers and turbo-alternators is connected directly to the terminals of the alternator. The supplies to the non-essential auxiliaries, i.e., those performing general station duties whose continuous availability is not of over-riding importance, and the stand-by and starting-up supplies, are obtained from station transformers supplied from the main 66 kV and 132 kV switchgear. The large auxiliary motors operate at 6 kV and the smaller auxiliary motors are designed for 400 V for the "A" station and 415 V for the "B" and "C" stations.

The 6 kV switchgear is oil-immersed and metalclad, and the 400 and 415 V switchgear is of the air-insulated air-break type. The essential auxiliary supply circuits are remotely controlled from the operating room. The essential auxiliaries are remotely controlled from the boiler control panel or from a position adjacent to the turbo-alternator. The control of non-essential auxiliaries is effected adjacent to the equipment concerned.

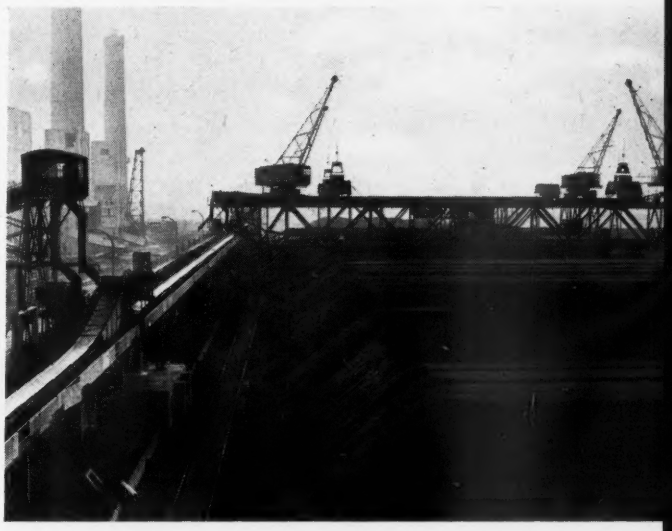
Circulating water is drawn from the Thames through two intake tunnels, each 9·5ft in diameter and 275ft long, below the coaling jetty, the mouths of these tunnels being protected by large timber screens; the water is passed through Brackett moving screens to the pump suction culvert. The pump house is situated to the west of the north end of station "A" about 200 yd away. There are nine vertical Drysdale pumps driven by 6 kV Metrovick motors. Two of these have a capacity of 24,000 gal/min each and seven a capacity of 42,000 gal/min each. The pumps deliver to a common condenser inlet culvert via five inlet channels of varying cross-section.

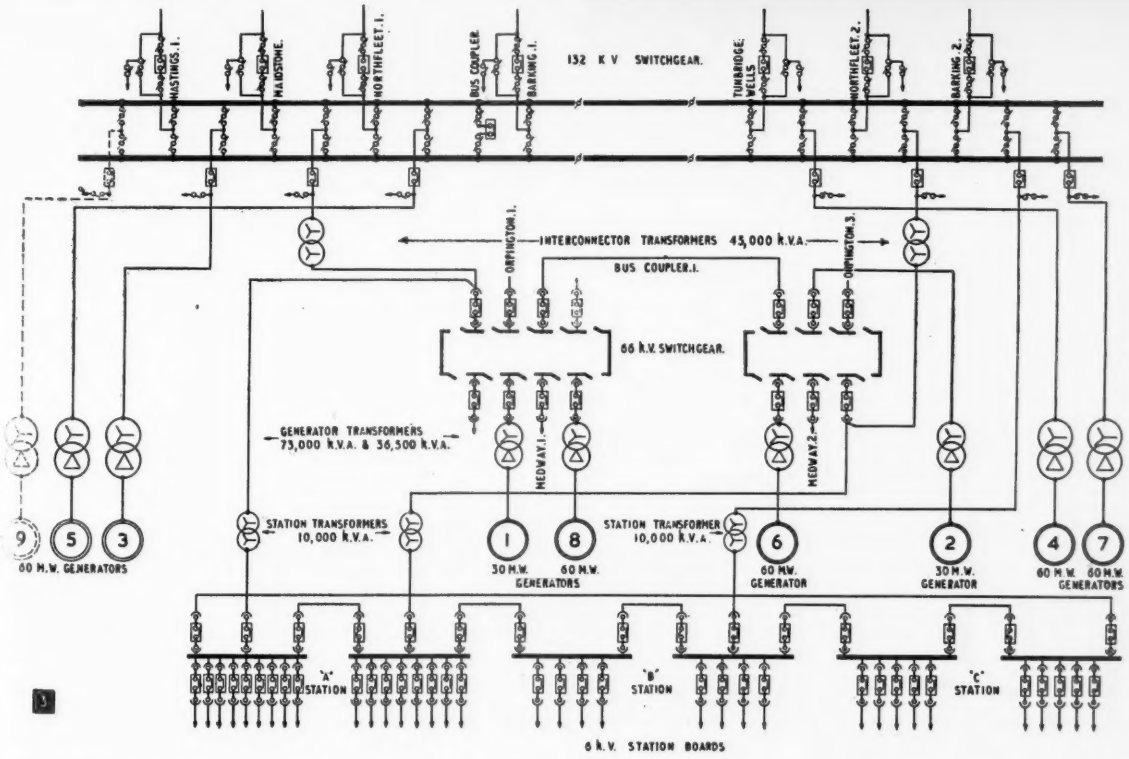
The water passes direct from the inlet culvert through the condensers and to a common outlet bus main from which there are five outlet culverts to the river, the discharge point being about 270 yd downstream from the intake.

The coal handling plant is designed primarily for

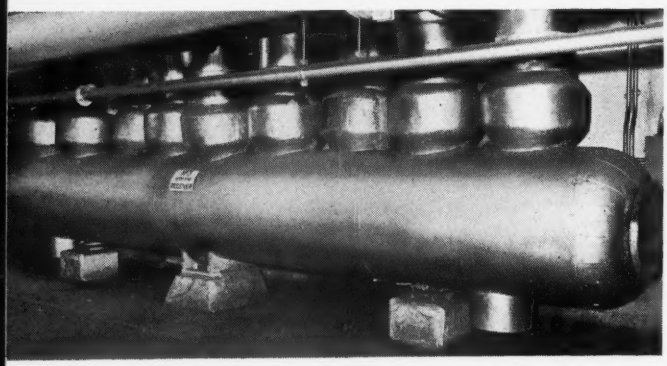
Water-borne coal is unloaded at an island jetty

Coal handling plant and coal storage are common to all three stations





Station " A " boiler house is equipped with both stoker fired and p.f. fired boilers; coal distribution arrangements



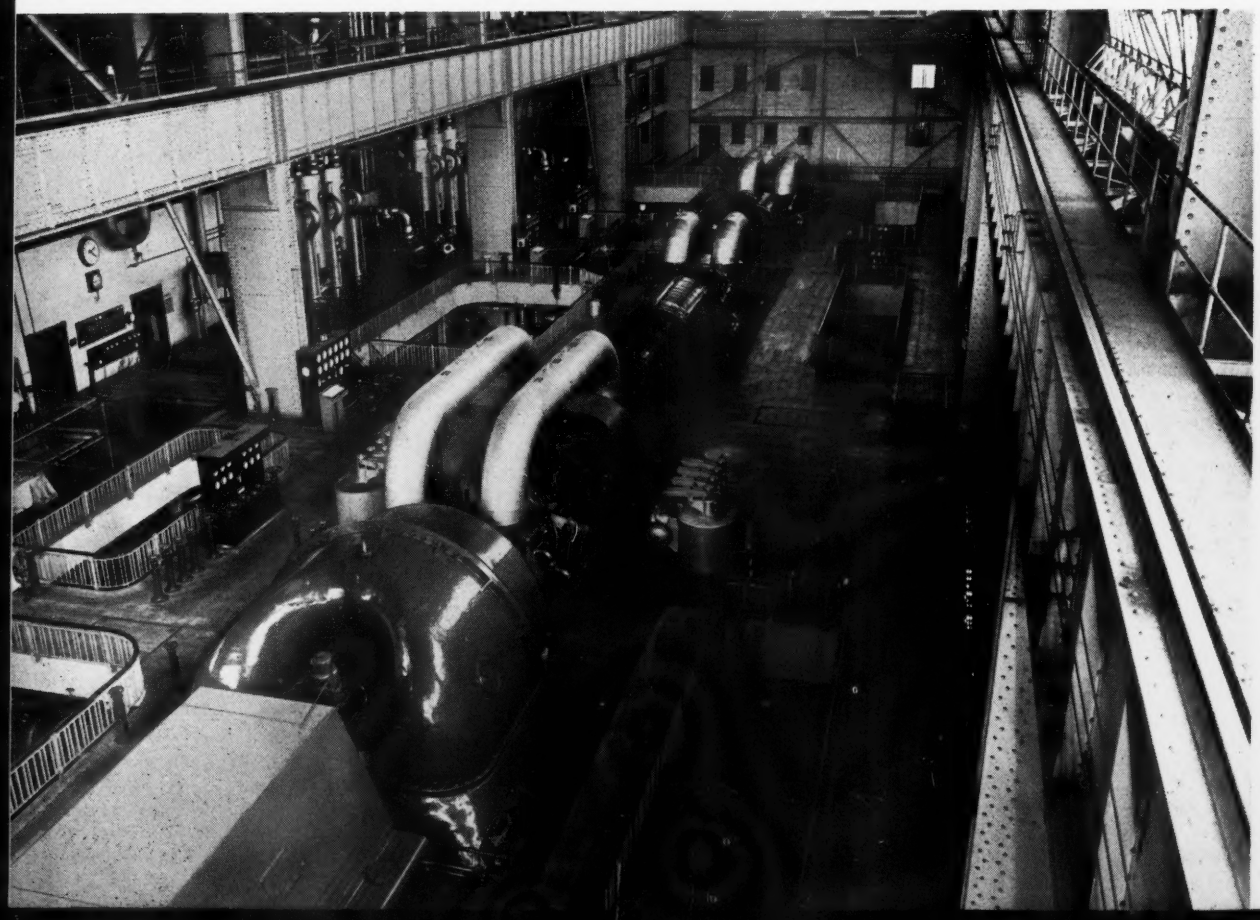
dealing with river-borne coal, but a wagon tippler and conveyors have been installed to enable coal to be received by rail if desired. Coal delivered to the site can be conveyed either to the boiler house bunkers or deposited in the coal store. River-borne coal is brought by collier to an island jetty 334ft long at the north-west corner of the power station site. This is constructed of ferro-concrete and will accommodate 6,000 ton colliers; the depth of water at extreme low tide is about 15ft. At present there are three coal unloading cranes and there are two others in the course of construction, all supplied by Stothert & Pitt, Ltd. The four-motor travelling and balanced luffing type jetty cranes travel on a 23ft 6in gauge track. The maximum unloading rate of each crane is 200 tons per hour.

The main conveyor system is of the Fraser & Chalmers belt type. At present the principal items are as follows: conveyor No. 1 runs from west to east along the south side of the coaling jetty and is capable of handling 600 tons per hour. The coal is discharged at the east end of the belt into a chute which feeds an inclined conveyor, No. 2, running parallel with the road which connects the jetty with the shore; conveyor No. 3 runs in a north–south direction for the total length of the three stations; No. 4 conveyor runs parallel to No. 3 conveyor from south to north.

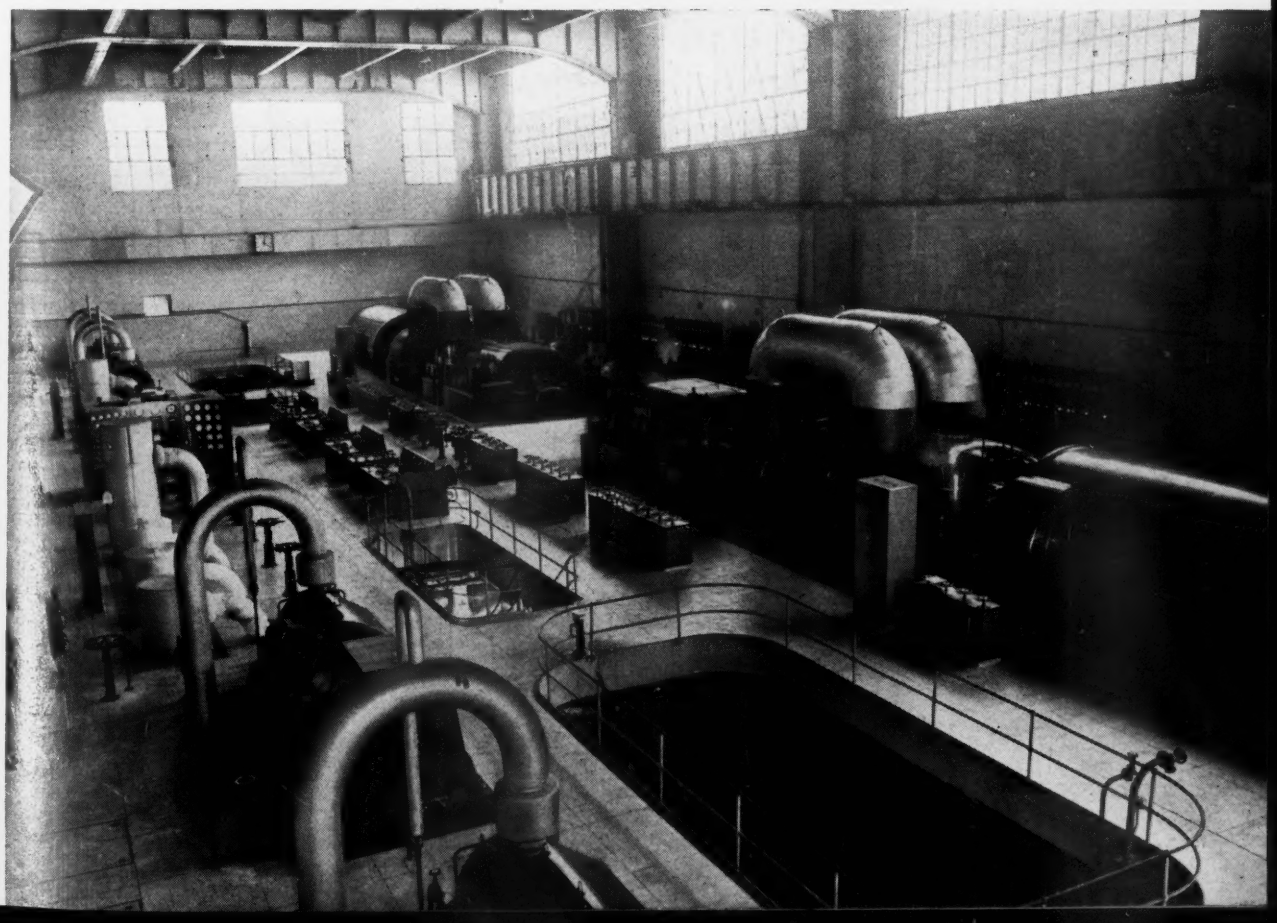
The coal store is on the west side of the conveyors and is designed to hold a final stock of 250,000 tons. It is spanned by two travelling bridges, each with two reclaiming cranes. On the bottom chord of each travelling bridge is a belt conveyor by which the coal is passed to store.

For reclaiming coal from the running coal store two cranes are provided on the top chord of the bridge, operating in conjunction with conveyors. The cranes may also be used, if desired, for spreading the coal on the store in addition to reclaiming it therefrom. An extension to the south end of the main coal store is under construction,

Steam receivers characterize the semi-flexible load requirements of station " A " and (below) the 60 MW and two 30 MW turbo-alternator sets in station " A "



There is no partition between the boiler and turbine houses in Littlebrook "B" (above) and "C."
Feed pumps in station "B" are in the bay between the boiler and turbine sections as depicted below



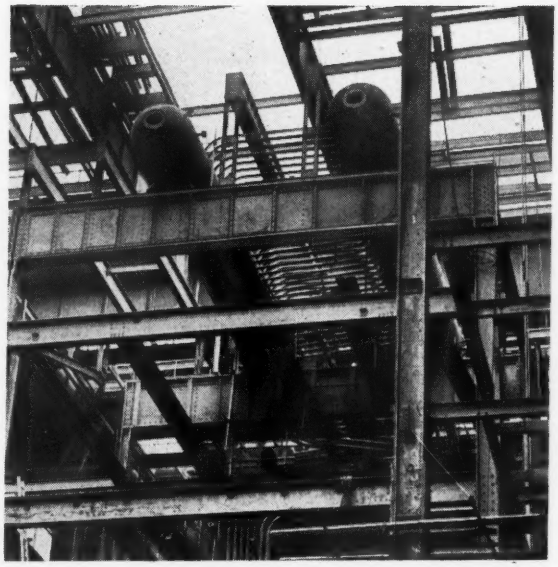
consisting of a centre storage conveyor and two reclaiming conveyors for use with bulldozers and scrapers.

Coal is carried to the station " A " boiler house overhead storage bunkers by two gravity bucket conveyors, whereas in the cases of " B " and " C " stations inclined belt conveyors are used. Provision is made for weighing the total quantity of coal from the ship, and individual machines measure the weight of coal passing to each station.

The ash disposal area is on the east side of the station group site and consists of nine settling ponds—three for each station. The ash and dust from " A " and " B " stations and the ash from " C " station are pumped out to these lagoons, but in the case of station " C " the " Hydrovac " system is used to remove dust from the precipitator hoppers, discharging to two bunkers from which the dust is removed by lorry.

The power station site at Littlebrook is about 1·5 miles N.N.E. of Dartford on the south bank of the Thames at a point where the river runs from north-west to south-east. The power station buildings are of steel and concrete construction and are entirely separate, except for communication corridors between stations " A " and " B " and again between stations " B " and " C." The three buildings are aligned in the direction north-east to south-west, station " A " being at the north-east end of the line or nearest to the river. The accompanying plan of the site shows the relative positions of the main components.

Station " A " contains two twin cylinder double flow l.p. 30 MW 3,000 r.p.m. Parsons turbo-alternators generating at 11·8 kV and one twin cylinder single flow l.p. 60 MW 1,500 r.p.m. B.T.H. 15 kV set. The boiler house is at right angles to the turbine house and the boiler plant



Station " C " boilers under construction

consists of three p.f. boilers by International Combustion, Ltd., and three stoker fired Babcock & Wilcox boilers, all rated at 256,000 lb/hr. The steam conditions are 600 lb/sq in and 800 deg F at the turbines. Station " A " was described in the *Electrical Review* of 25th July, 1947.

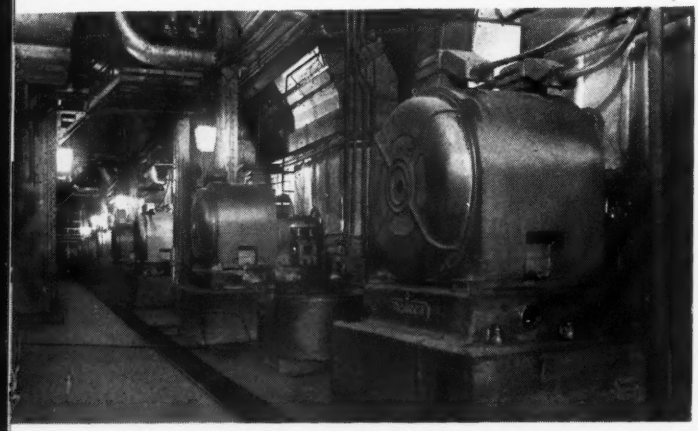
Station " B " was planned in 1938–39 and contracts were placed before the war. Work was suspended as the result of the war, however, and new contracts were placed in 1945. The station was planned for base-load operation with two Metrovick 60 MW 3,000 r.p.m. three cylinder double flow l.p. turbines driving hydrogen cooled 11·8 kV alternators. The steam conditions at the turbine stop valves are 1,235 lb/sq in and 825 deg F, with re-heating to 825 deg F. It has since been agreed to operate at 840 deg F. It was decided to adopt the unit principle with two re-heater boilers per turbine. Work on the station " B " foundations began in 1945, steelwork erection was started in 1946 and the first machine was commissioned in 1949. The turbo-alternators are arranged longitudinally (the steam ends being adjacent) with a parallel boiler house and a central bunker bay. There is no dividing wall between the turbine and boiler houses.

The boiler house building embraces the electrostatic precipitators and boiler switchgear chambers at the rear of the boilers. Each turbine has a specified economical rating of 48 MW. The h.p. turbine component exhausts to the re-heaters at 355 lb/sq in gauge and 555 deg F at the maximum rating, and the re-heated steam is admitted to the i.p. cylinder through interceptor and emergency valves. The governor valves are pre-set to start closing at 2 per cent above the normal speed and they operate on their own governor.

The main h.p. trip gear operates the emergency valves. Turbine supervisory gear to record eccentricity and axial movements is provided for the h.p. and i.p. shafts. The feed is heated by two l.p. and four h.p. heaters to 420 deg F.

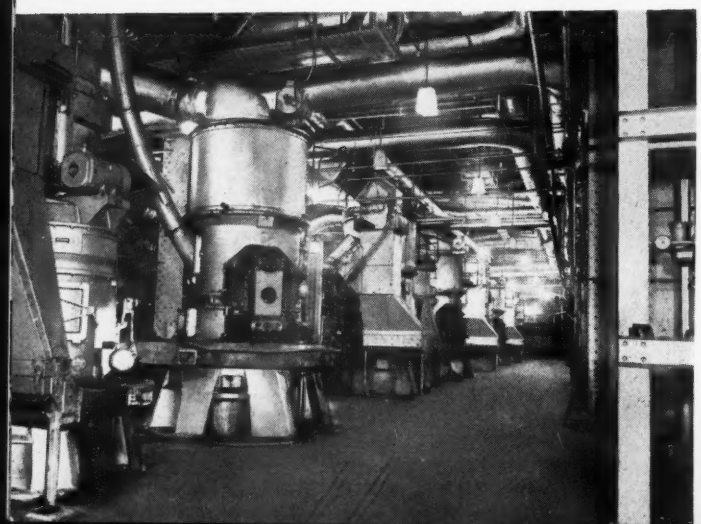
There are two full capacity feed pumps per unit, each rated at 570 lb/hr and driven by 1,850 b.h.p. 3,000 r.p.m. motors. The exciters are separately driven by 380 h.p. motors, each equipped with a flywheel as a driving set, and are designed to provide excitation during abnormal conditions when the supply voltage and frequency may be low.

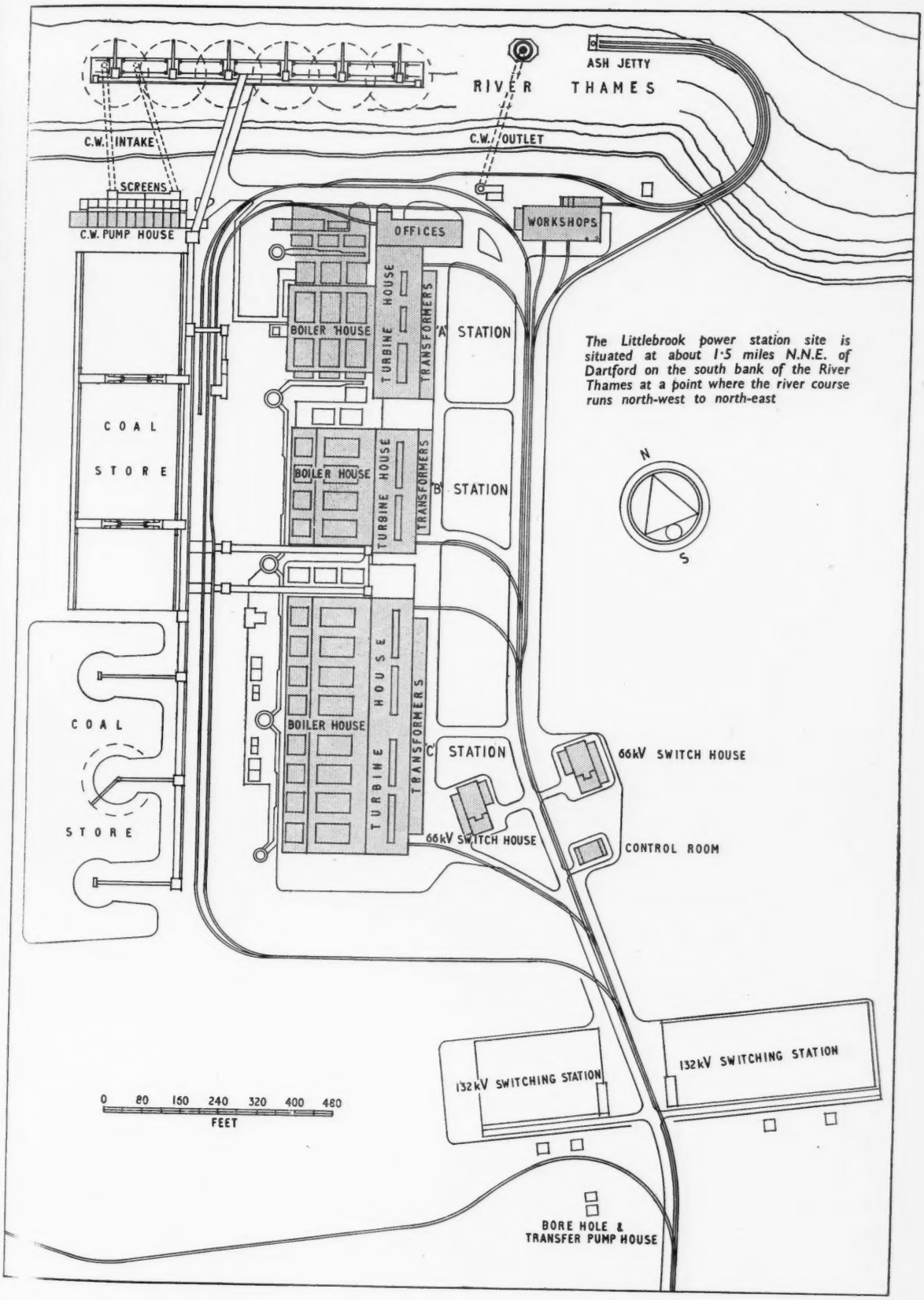
The International Combustion p.f. boilers have a



There are two f.d. fans per boiler in station " B "

In station " C " there are three vertical p.f. mills per boiler

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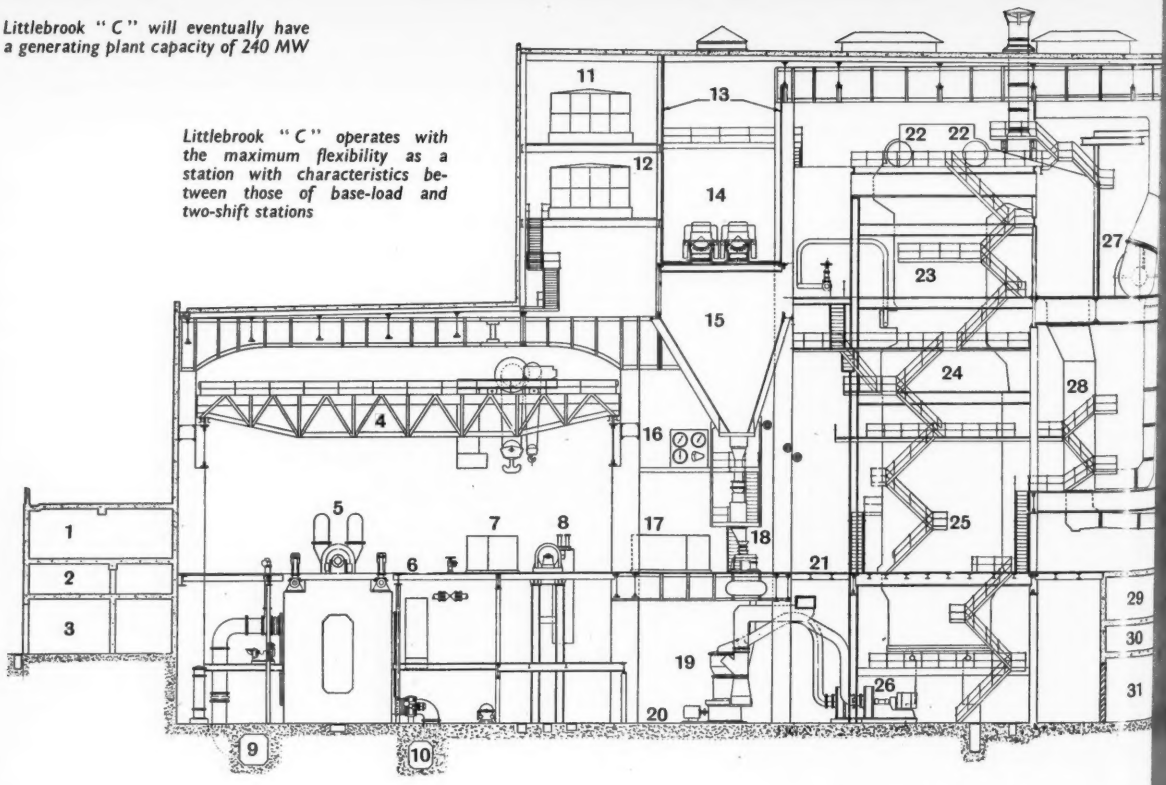
The Littlebrook power station site is situated at about 1·5 miles N.N.E. of Dartford on the south bank of the River Thames at a point where the river course runs north-west to north-east

Littlebrook "C" will eventually have a generating plant capacity of 240 MW

Littlebrook "C" operates with the maximum flexibility as a station with characteristics between those of base-load and two-shift stations



maximum continuous rating of 264,650 lb/hr, with conditions of 1,310 lb/sq in and 850 deg F at the superheater outlet while re-heating 232,865 lb of steam to the initial temperature of 850 deg F. The re-heater temperature is controlled by the remote manually operated by-pass damper and the primary steam by an automatically controlled attemperator. There are two f.d. and two i.d. fans per boiler, each driven by a two-speed motor and situated at ground level.

The gases from the re-heater outlet pass through a secondary air heater, economizer and primary air heater (the last mentioned being on the suction side of the f.d. fans) before passing to the precipitators. The boilers are equipped for operation on the Bailey automatic control system.

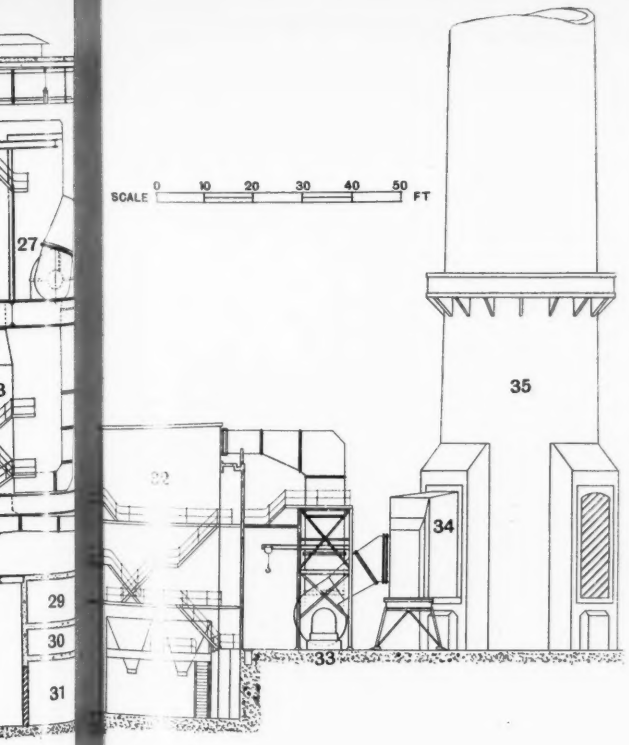
The pulverizing plant consists of two type LM13 vertical mills and one type LM8 vertical starting mill per boiler. Each main mill serves four corner burners which are arranged for tilting through an angle of ± 15 deg. Flanges of the Corwel type are provided only at the terminal points and at valves on the main steam pipework, all intermediate joints being butt welded. The feed piping system, which has a design pressure of 1,880 lb/sq in, is of carbon steel and butt welded throughout, again with the exception of valves and terminal points where Corwel flanges are provided. The main steam pipework is of 0·5 per cent carbon-molybdenum alloy steel and the re-heat pipework is of carbon steel.

The direction for station "C" was made in 1947 and this station, when completed, will contain four 60 MW Parsons three cylinder double flow l.p. turbines driving hydrogen cooled alternators, and seven 360,000 lb/hr International Combustion boilers with the standard steam conditions of 900 lb/sq in and 900 deg F at the turbine and 975 lb/sq in and 915 deg F at the boiler. The turbo-alternators have gear driven exciters and the turbines are provided with supervisory gear. There are two l.p. and three h.p. feed heaters, the boiler feed water temperature being 385 deg F. The boilers are automatically operated on the Bailey control system and the superheat temperature control on the boilers is effected by tilting burners, no de-superheaters being installed.

The two damper controlled i.d. fans are driven by two-speed motors and the two damper controlled f.d. fans by single-speed machines. The pulverizing plant comprises three type LM12 vertical mills per boiler. The boiler feed pumps will eventually comprise five motor driven units, each rated at 630,000 lb/hr, and two turbine driven 650,000 lb/hr units. The steam piping comprises one 10in pipe from each boiler and two 9in pipes to each turbine. These pipes are connected to a common manifold with a 12in cross-section. The tube material is 1 per cent chromium and 0·5 per cent molybdenum alloy steel. The system is butt welded throughout except at the valves and the terminal points where Parsons seal welded flanges are provided.

Provision is made on the steam piping system to enable the progressive creep to be observed. The feed water piping comprises a 10in pump discharge main connected through the heaters to 10in duplicate interconnected mains in the boiler house. The material is carbon steel and again the system will be butt welded throughout; all butt welds are examined by radiography, using the single wall technique with the radioactive capsule inserted into the pipe bore.

We are indebted to Mr. W. C. Parker, M.I.E.E., M.Inst.F., Controller of the South Eastern Division, British Electricity Authority, for permission to visit the station and to prepare and publish this article, and to Mr. E. C. Avery, station superintendent, and Mr. W. Wright, efficiency engineer, Littlebrook, for their help in preparing the article.



KEY TO LITTLEBROOK "C" POWER STATION CROSS-SECTION

1. Station Auxiliaries Switchgear.
2. Cable Chambers.
3. Station Auxiliaries Transformers.
4. Turbine House Crane.
5. Turbo-alternators.
6. Operating Floor; +35ft level.
7. Turbine Instrument Boards.
8. Feed Water Pumps.
9. C.W. Outlet Culvert.
10. C.W. Inlet Culvert.
11. Softened Water Tanks.
12. F.W.; R.W. and Hotwell Tanks.
13. Dust Screens.
14. Coal Bunker Conveyors.
15. Coal Bunkers.
16 & 17. Boiler Instrument Boards.
18. Coal Feeders.
19. P.F. Mills.
20. Basement Floor; +5ft level.
21. Firing Floor; +35ft level.
22. Boiler Drums.
23. Superheater Zone.
24. Combustion Chamber.
25. Corner P.F. Firing Burners.
26. P.F. Exhauster.
27. F.D. Fans.
28. Air Heater.
29. Station Auxiliaries Switchgear.
30. Cable Chambers.
31. Station Auxiliaries Transformers.
32. Electrostatic Precipitators.
33. I.D. Fans.
34. Main Flue Ducting.
35. Chimney.

The General Vector Diagram

1.—Conventions and Notations

By M. G. SCROGGIE, B.Sc., M.I.E.E.

A YEAR or two ago* I discussed the various conventions relating to the identifying of voltages and currents in circuits and vector diagrams, and tentatively introduced a form of vector diagram for which the description " general " seemed appropriate. Since then the system put forward has abundantly proved its advantages in my own work, which is in the field of communications, and what is felt to be a valuable and apparently new current notation has been added. In the earlier article I recognized that people who propose new conventions in a well-established field are prima facie guilty of committing a nuisance, and that the onus is on them to establish their innocence by proving that their proposals possess more than slight or theoretical advantages and are worth the temporary confusion and effort of changing over. It is therefore only after further consideration and exposure to criticism have failed to " shoot it down " that I venture to put forward the system once again, this time in more developed form. Criticism or comment will be welcomed.

Having recognized also that to be acceptable a system of electrical conventions ought to be applicable to the " heavy " as well as the " light " branches of the industry, I have obtained the opinions of friends experienced in the teaching of heavy electrical engineering. The conclusion so far seems to be that although the balance of advantage is perhaps less than in communications it does exist, and that there is no fatal flaw in its application to typical power problems. I hope later on to give some examples of these.

The system now comprises:—

(1) A convention regarding the sense of the double-subscript notation for voltages.
(2) An analogous notation for currents.
(3) The generalized form of vector diagram.

These can to some extent be accepted or rejected individually. If the voltage notation were considered on its own it would probably be rejected, because it is opposite to the convention adopted by the majority of writers—the " potential-fall " convention, by which " V_{ab} " means " the voltage of a with respect to b." For this reason I hesitated to retain the " potential-rise " convention (by which " V_{ab} " means " the voltage change in the direction $a \rightarrow b$ "), since the sacrifice of this feature might make the rest of the system more acceptable to those who would otherwise be prejudiced against it. And indeed it must be emphasized that either voltage convention can be used in conjunction with the other features. But the " potential-rise " has such pronounced advantages in the interpretation of the vector diagrams that in what follows it will be used. Incidentally, in the correspondence provoked by the earlier article the balance of opinion was surprisingly in favour of the " potential-rise."

The notation for currents, which as far as I have been able to discover is new, does not contradict any existing system, but replaces the existing lack of system, and therefore I have no hesitation in proposing it. The general form of vector diagram is at its best when these voltage and current notations are used, but is not entirely dependent on them. Before going into details let us enumerate the shortcomings of ordinary vector diagrams:—

(1) To render them unambiguous it is necessary to furnish both circuit and vector diagrams with arrows and labels for all currents and voltages.
(2) The choice of sense for the arrows is more or less arbitrary, and different diagrams can be drawn to represent the same situation, to the confusion of students.
(3) The practice of making all the vectors radiate from a point appears to endow that point with some special significance when in fact there may be none. Someone else may draw an equally correct diagram using some other point in the circuit as reference. (This reminds one of the specially-favoured frame of reference condemned by Einstein in his theory of relativity.)
(4) The vector diagram does not *immediately* show the potential of every point in the circuit relative to every other point at any desired phase of current or voltage.
(5) Notation for currents is arbitrary and illogical.
(6) There is disagreement as to whether, for example, the voltage across a transformer primary should be shown in phase with or opposing the voltage of the source.

By contrast, the following features are possessed by general vector diagrams used with the recommended notation:—

(1) No arrows are needed on either circuit or vector diagram, and voltage and current notation are completely unambiguous and can be specified in either direction, no matter how complicated the circuit network (with a certain reservation as regards the current notation).
(2) The vector diagram is completely general, no particular reference point in the circuit being assumed; and for any given phase in the cycle it is unique.
(3) The phase relationships of all currents and voltages in either direction can be seen, without the space-wasting and possibly confusing practice of drawing vectors radiating in opposite directions.
(4) The potential of every point in the circuit can be seen, relative to every other point, whether or not there is actually a circuit path between them.
(5) A particular vector diagram (i.e., one referred to a chosen point in the circuit, such as earth) can easily be derived from the general diagram. This type of diagram is essentially the same as that commonly used, which can therefore be treated as a particular case of the general diagram.
(6) The system as a whole is in harmony with basic electrical principles and assists the teaching thereof.
(7) There are indications that it is sufficiently sound and fundamental to be made the basis for further development.

Voltage Notation

The advantages of the double-subscript notation hardly need to be argued at this date, and are I think generally acknowledged. Unlike the other systems, it

* " Circuit and Vector Diagram Conventions," *Electrical Review*, 9th February, 1951, p. 267.

unmistakably and conveniently specifies the two points (marked on the circuit diagram) between which the voltage exists, and does not leave it to be inferred or guessed what the reference point is. The only thing to be settled is direction or sense. If "V_{ab}" is interpreted as "the voltage of a with respect to b," or

$$V_{ab} = V_a - V_b$$

then a positive value of V_{ab} means that a is positive with respect to b, so in moving from a to b there is a fall in potential. The alternative interpretation is "the voltage change in the direction $a \rightarrow b$," or

$$V_{ab} = V_b - V_a$$

and if this convention is adopted a positive V_{ab} means a potential rise in that direction.

Note that either way it makes no difference which circuit path (or absence of circuit path) between a and b is considered—there cannot be more than one difference of potential at a time between the same two points. In Fig. 1 the generator may be producing an instantaneous positive e.m.f. clockwise, in which case the inductor must be producing a positive e.m.f. anticlockwise, but that does not alter the fact that b is positive with respect to a.

Provided that it is known which convention is being used, there is no need to mark an arrow on the circuit diagram. With the potential-rise convention the situation in Fig. 1 with b more positive than a would be described as V_{ab} positive (or V_{ba} negative); with the potential-fall convention, V_{ba} positive (or V_{ab} negative). Why, then, should it commonly be considered necessary to fit the voltage vector with an arrow head? Presumably because it is customary to label the vector V_{ab} (say), and without the arrow head one would not know which way the vector was acting. Then why not abolish both label and arrow head and simply mark one end of the vector a and the other b? Besides saving effort and improving the clarity of complicated vector diagrams it enables the same vector line to represent both V_{ab} and V_{ba}.

One reason why potential-fall exponents may be reluctant to do this is the well-established convention in electrical vector diagrams that "up" is positive and "down" is negative. All electrical engineers, therefore, on being told that Fig. 2 was a vector diagram representing a phase of Fig. 1, would correctly infer that b was at maximum positive with respect to a. They would also (in common with all geometricians) refer to the vector line in its upward (and therefore positive) sense as "ab." This is somewhat embarrassing to the potential-fall convention, to which V_{ab} is at this moment maximum negative; but it suits the potential-rise convention admirably.

The position, then, is as follows. Fig. 2 is not only simpler than Fig. 3 (as well as possessing other more considerable advantages in multi-vector diagrams), but it enables the voltage it represents to be specified in either sense, which is useful when it is not desired to restrict the diagram to one particular reference point a or b. If one insists on the potential-fall convention, however, it is necessary either to (i) give up these advantages, or (ii) adopt the unnatural practice of interpreting ba in V_{ba} as the *upward* direction of the line in Fig. 2, or (iii) adopt the equally unnatural practice of interchanging a and b in Fig. 2 and interpreting the downward position of b as its being positive with reference to a.

The potential-rise convention, on the other hand, leads to a simple and mistake-proof correlation of vector diagram with circuit diagram. In the simplest possible way, Fig. 2 shows clearly that b in Fig. 1 is at its positive peak with respect to a, and that a is at its negative peak with respect to b. Fig. 2 is, of course, supposed to be rotating anticlockwise, so future and past phases can be inferred. If now one decides (or is informed) that a is earthed or is arbitrarily taken as zero voltage, this is represented in Fig. 2 by making a the centre of rotation, which can be indicated by drawing a small ring round that end of the line, or an arrow head at the other end, or both. The general diagram is converted into a particular diagram, similar to the ordinary kind except for the convenient letter correlation. It is, of course, obviously right that the one motionless point on the vector diagram should be labelled with the same letter as the zero-voltage point in the circuit.

There are other implications of the choice of voltage convention. With the potential-rise, the direction of e.m.f. in a source is the same as the direction in which the e.m.f. tends to drive current. This alone seems so natural (and the reverse so unnatural) as to justify this convention. A suitable emblem for users of the potential-rise convention, to be displayed at the corner of diagrams in which it is used, is shown here as Fig. 4. Since there are still a few people who suppose the long stroke of a cell symbol to be negative, it might be wise to make quite sure by marking it +. It follows that the direction of current through a sink (i.e., load) is the same as the direction of the applied e.m.f., *regarding the rest of the circuit as the source of that e.m.f.*, and opposite to the back e.m.f. or voltage drop due to the load.

Thus in Fig. 5, if the instantaneous e.m.f. of the generator is supposed to be positive clockwise, V_{ab} (or E_{ab}, if one wishes to emphasize that it is an e.m.f., though no error can arise through failing to make the distinction) is positive, acting upwards through the generator, and that is the direction in which it drives current around the circuit. Considering the load, one can say that the current is in phase with the applied e.m.f., acting clockwise, or opposite in phase to the voltage drop in the resistance, acting anticlockwise internally. In Fig. 6 the clockwise current through R is in phase with the applied e.m.f. which in this

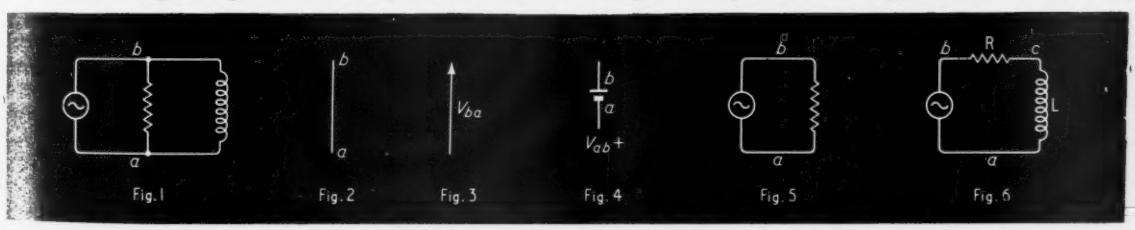


Fig. 1.—Provided that the sense convention is known, V_{ab} (or V_{ba}) completely specifies the voltage across all three circuit paths without the need for any arrows

*Fig. 2.—This, the general voltage vector diagram for Fig. 1, is simple and convenient, and shows that **b** in the circuit is at peak positive with respect to **a***

Fig. 3.—Conventional voltage vector diagram for Fig. 1

Fig. 4.—Emblem denoting use of voltage-rise convention

*Fig. 5.—When **b** is positive with respect to **a**, a positive e.m.f. V_a is acting clockwise in the generator, driving current in the same direction, and is applied to the load*

Fig. 6.—V_{rb} can be regarded as the e.m.f. applied clockwise to R—the resultant of the e.m.f.s in L and the generator—in phase with the current, or as a back voltage in R opposing the current, or both

case is V_{cb}, the total voltage acting clockwise between c and b; i.e., the resultant of the voltages caused by L and the generator. Alternatively one can say that the current is opposite in phase to V_{cb}, regarded as the voltage acting anticlockwise in the resistor. Similarly, the clockwise current through L lags V_{ac} by 90 deg, V_{ac} being considered as a clockwise applied e.m.f. or an anticlockwise back e.m.f. developed by the changing flux linkages in L. It is a matter of personal preference which way—internally or externally—one looks at the voltage between two points in a circuit.

This, although apparently such an elementary matter, is vitally important in any system. Although the interpretations just given seem logical and in accordance with accepted electrical principles, engineers accustomed to the potential-fall notation may at first find it strange to refer to the voltage in phase with the current flowing from b to c in Fig. 6 as V_{cb}. Personally I think some temporary strangeness is worth suffering for the sake of having a consistent and natural system with undoubted practical advantages, for those advantages remain long after the strangeness has been forgotten. The possibility of confusion during the change-over can be ruled out by marking work with the badge, Fig. 4.

Current Notation

First of all let us dispose of any uncertainty as to what is meant by the direction of current. If one could wipe the slate clean and start afresh there is little doubt that the present convention would be reversed, by reckoning the direction of current as the direction of electron drift. At intervals someone proposes that this should be done, but even in the field of electronics, where one is most conscious of anomaly, the traditional direction of current —opposite to electron drift—remains firmly established. The upheaval caused by changing over would be very great, and the advantage doubtful, for the direction of current would become opposite to the direction of positive ion drift! Admittedly one is more often interested in what electrons are doing, but the fact that an electric current does not necessarily consist exclusively of motion in either direction weakens the argument for insisting on the electron direction as the current direction.

Having settled in favour of tradition, we next consider how to identify currents in circuit and vector diagrams. Sometimes the double-subscript system as used for voltages is adopted; for instance, in Fig. 6 a current flowing through R from b to c would be denoted by "I_{bc}". There are two fatal objections to this system. Even in a simple series circuit it does not make the direction of current unmistakable. Is I_{ba} the current flowing clockwise through the load or anticlockwise through the generator? And in parallel circuits it breaks down completely, for there is no indication which of the several currents that may be flowing between the two named points is meant. One way out of this difficulty is to add more subscripts, which is clumsy and liable to lead to trouble with the printer; another is simply to number the currents I_1, I_2, etc., which is arbitrary and unsystematic and makes it necessary to mark them on the circuit *and* add an arrow to each to indicate their direction.

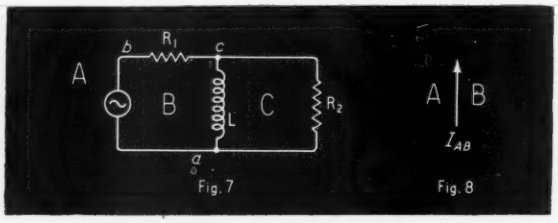


Fig. 7 Fig. 8

Fig. 7.—All the currents in a network can be identified by the meshes between which they flow, such as A, B and C here

Fig. 8.—Emblem denoting current-direction convention

In contrast to this absence of system the following notation is both logical and convenient. Just as current is the "dual" of voltage, so the dual of a circuit junction or node is a circuit mesh. Therefore, since the voltage notation is based on the lettering of circuit junctions, the appropriate elements for distinguishing currents are the circuit meshes. Consider Fig. 7, for example. Here there are three junctions, marked a, b and c, for identifying all the voltages across the four circuit components. The three currents can be unambiguously identified by lettering the meshes A, B and C as shown. Incidentally, this system is analogous to Bow's notation for structures. Since any correspondence between similarly-lettered currents and voltages (e.g., V_{ab} and I_{AB}) is purely coincidental, and A is the same as a when spoken, one may prefer to use either different letters for the meshes, or numbers.

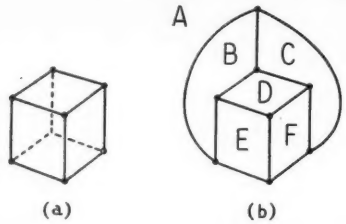


Fig. 9.—The circuit network corresponding to the edges of a cube (a) can be redrawn without cross-overs (b), so that the mesh current notation can be applied without complications

Not only does use of this system ensure a separate name for each current, but also once a convention has been agreed upon the direction of every current is indicated without individual arrows, just as in the corresponding voltage notation. This convention is purely arbitrary, and the one I have adopted is indicated by the emblem, Fig. 8, which explains itself. The first letter in the subscript denotes the mesh around which the current flows in the positive (i.e., anticlockwise) direction; the second letter denotes the adjacent mesh. Thus in Fig. 7 I_{AB} means the current flowing from a through the generator to b and then through R_1 to c. Here it divides into two: one, I_{CE} through L from c to a; and the other, I_{AC}, through R_2 to the same point. According to the potential-rise convention used in these articles, the e.m.f. driving current through R_2 (or alternatively the voltage drop in it) is denoted by V_{ac}, so I_{AC} is in phase with V_{ac}; also I_{CA} (which, of course, is $-I_{AC}$) is in phase with V_{ca}. Similarly, I_{CB} lags V_{ac} by 90 deg. This current notation works equally well along with the potential-fall convention, the only difference being that the voltage subscripts are interchanged.

But it has one practical limitation. It can only be

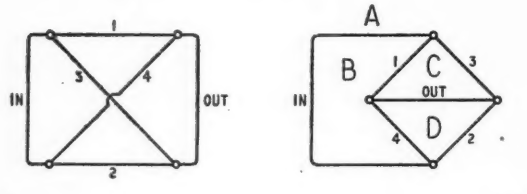


Fig. 10.—The lattice filter network (a) can be redrawn without cross-over as a bridge (b)

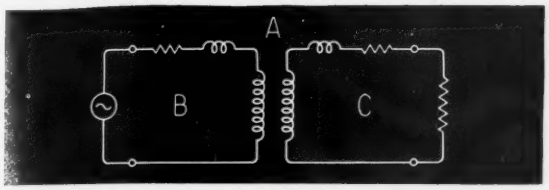


Fig. 11.—Theoretical equivalent circuit of a transformer, with mesh notation

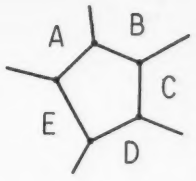


Fig. 12.—Kirchhoff's first law is true not only of a node but also of a larger junction, as, for example, the mesh enclosed by A—E

applied reasonably simply to circuit networks that are "flat," that is to say, it can be drawn only without cross-overs. This is not so serious as might at first be expected, for there are surprisingly few circuits of practical interest that are "solid." Even the network formed by the edges of a cube, Fig. 9 (a), can be redrawn without cross-overs as in (b), enabling the currents in all twelve arms to be labelled in terms of the six meshes A–F. One of the awkward exceptions is a system comprising three 3-phase "stars" in parallel. Any number of deltas can, of course, be shown in parallel without cross-over; so can one or two stars and any number of deltas. The lattice filter, Fig. 10 (a), can be redrawn as a bridge (b). And so on, for most circuits for which vector diagrams are likely to be desired. The advantages of this notation are not the only reasons for drawing circuits without cross-overs. Increasing attention is very rightly being paid to the clarity of circuit diagrams, and it is generally accepted that if they can be drawn without cross-overs they ought to be so drawn. Use of this current notation, therefore, incidentally tends to encourage the clearer presentation of diagrams.

Transformers are particularly important where vector diagrams are concerned, and an example will be given later, but in the meantime Fig. 11 shows how the mesh notation is applied to the usual "equivalent circuit," consisting of an ideal transformer with resistance and inductance in series with primary and secondary. It is interesting to note that "I_{BC}" denotes the net current flowing upwards in both windings ($= I_{BA} + I_{AC}$), and if the turns ratio is 1 : 1 this is the magnetizing current; the primary load current is cancelled out by the equal and opposite secondary load current.

Kirchhoff's Laws

The simplest and clearest form of Kirchhoff's laws is that which can be expressed in symbols as

(1) $\Sigma I = 0$ at any node (junction)
(2) $\Sigma V = 0$ around any mesh

These are self-evident, for if there *were* any net current at a node either a positive or negative charge would be accumulating there, and since a node is regarded as a point it has no magnitude and therefore no capacitance. Similarly, if the sum of the potential changes around any path (conducting or otherwise) were not zero, the starting and finishing point (being the same) would have to be at two different potentials at the same time, which is absurd. The form of the second law that necessitates distinguishing between e.m.f.s and voltage drops introduces unnecessary complications. All that is needed is to reckon voltages one way round the path as positive and those in the opposite direction as negative. Similarly, if currents arriving at any point are reckoned as positive, those leaving it must be negative.

The recommended notation is in full accordance with these principles. Consider, for example, node *c* in Fig. 7. Current arriving from *b* is denoted by I_{AB}; current from *a* via L by I_{BC}; and via R_2, I_{CA}. So the expansion of "$\Sigma I = 0$" for this particular node is

$$I_{AB} + I_{BC} + I_{CA} = 0$$

It is a fact that any set of currents whose subscripts form a complete cycle, as in this example, must be equal to zero. This statement embodies a slight extension of Kirchhoff's first law, for such a set of currents need not necessarily meet at a node (see Fig. 12). $I_{AB} + I_{BC} + I_{CD} + I_{DE} + I_{EA}$ add up to the current leaving the central mesh. This mesh, if it had stray capacitance to earth or elsewhere, might have a net current leaving or entering it; but such a breach of the law would be only apparent, being due to part of the network (the stray capacitance) being omitted from the diagram.

Similarly with the second law, taking the mesh B in Fig. 7 as an example:

$$V_{ab} + V_{bc} + V_{ca} = 0$$

Provided that the convention used is clearly indicated (in this case, capital letters for currents and small letters for voltages) there is no need to repeat "I" and "V," and the notation can be abbreviated; for example

$$\mathrm{AB} + \mathrm{BC} + \mathrm{CA} = 0$$
$$ab + bc + ca = 0$$

Where much calculation has to be done this abbreviation saves considerable time and effort, and being clearer reduces risk of error. It is especially advantageous for printing. If it is used in speech, symbols must obviously be chosen that not only look different but sound different. In these articles it is necessary to distinguish between voltages, etc., and the vectors representing them, so this abbreviation will not be used.

The next instalment will deal with the construction of general vector diagrams.

I.MECH.E. PUBLICATIONS

THE Institution of Mechanical Engineers has this month started a new publication entitled the *Chartered Mechanical Engineer*, which supersedes the existing Institution *Journal*. The main function of the *Journal* was to acquaint members with the various activities of the Institution, but the new publication will, in addition, contain a high proportion of technical information. It will be issued monthly except in July and August.

Arrangements for publishing the proceedings of the Institution are also to be altered. Publication of the existing *Proceedings* (*A*) and (*B*), and *Automobile Division Proceedings* will cease, as such, in due course, but each paper will appear in full with its discussion as a separate issue of *Proceedings* (to be supplied to members on demand), thus materially speeding up final publication.

The Council has also decided to issue to all members (numbering about 40,000) summaries of papers accepted for publication. These will appear in the *Chartered Mechanical Engineer* four to eight weeks in advance of meetings at which the full papers will be presented.

The *Proceedings* of the Institution and of the Automobile Division will in future be bound annually into volumes, which will be available at a reasonable charge.

Overseas Electrical Trade

Substantial Improvement in Exports in November

FOLLOWING the general trend of trade, exports of electrical apparatus and machinery in November, at £16,234,638, showed an improvement over the figures both for the previous month (£13,986,260) and also for November, 1952 (£15,005,836). This is the first time since July that the total has surpassed that for the corresponding month of 1952.

Reference to Table I shows that the greatest improvement in business occurred in the goods and apparatus section and in washing machines, "other portable appliances" and portable tools. The total value of shipments of electrical machinery fell slightly, from £5,344,312 to £5,300,401, but the reduction in trade was confined to "other electrical machinery," both generators and motors being in greater demand. Overseas sales of vacuum cleaners declined from £163,866 to £99,982.

An interesting development in the changing world markets is the emergence of New Zealand from the position of about fourth largest buyer of electrical goods and apparatus to the prominence of becoming the United Kingdom's best customer. With purchases valued at almost twice those of November last year (£824,364 compared with £430,344), New Zealand bought considerably more than our next best customers, India (£637,058), South Africa (£604,788) and Australia (£564,850).

Another striking feature of the goods and apparatus exports is the increase from £23,454 to £511,414 in the sales to Russia, which rose to the position of fifth in the list. Poland's purchases also showed a substantial advance, from £14,667 to £73,007. Business with Pakistan continued good, rising from £167,794 to £441,088, while Canada too considerably increased its demands (£421,783 compared with £287,298). Both France and Belgium more than doubled their orders, but increasing home production was reflected in the decline of exports to Western Germany. The distribution of exports to other countries is given in Table II.

British East Africa (£116,625 against £62,298) made up to some extent for a reduction from £232,825 to £48,544 in sales of generators to South Africa. Other improving markets for generators were Australia, Russia, Holland, Norway and Pakistan. Sales to Canada fell from £131,348 to £32,255 and those to Brazil from £48,931 to £2,144. The best markets for motors were Australia (£124,900)

TABLE I.—ELECTRICAL EXPORTS

Class	November, 1952	November, 1953
	£	£
Telegraph and telephone cables and wires (submarine)	—	22,659
Ditto, not submarine	902,245	745,557
Cables and wires, paper insulated	886,863	971,691
Ditto, rubber insulated	431,746	386,937
Ditto, cotton, silk or artificial silk insulated	94,073	51,645
Ditto, enamel, glass or asbestos insulated	87,929	59,719
Ditto, other	258,752	264,981
Commercial radio apparatus	820,668	1,245,207
Domestic radio apparatus	298,173	275,747
Telegraph, telephone and signalling apparatus	1,286,890	1,517,438
Loudspeakers and microphones	45,135	40,313
Radio, telecommunication and electronic apparatus components and parts, n.e.s.	410,930	509,972
Other radio, telecommunication and electronic apparatus	230,717	404,793
Cathode ray tubes	12,174	8,293
Other valves	273,003	193,587
Carbons	19,360	13,550
Lamps, exceeding 24 V	58,773	90,017
Ditto, not exceeding 24 V	19,984	23,165
Other lighting appliances	453,882	427,163
Primary batteries	168,384	228,504
Parts other than carbons	10,120	35,614
Accumulators for motor vehicles	122,904	176,710
Ditto, traction	13,179	15,162
Ditto, radio	2,989	5,923
Other portable accumulators	124,091	34,544
All other accumulators	56,095	45,434
Parts and accessories	85,816	76,680
Cooking appliances	86,520	104,532
Heating appliances	83,109	74,268
Parts and accessories for cooking and heating appliances	85,179	85,582
Flat irons	77,725	70,609
Commercial electrical instruments	154,413	196,270
House service meters	86,969	112,507
Time recorders and time switches	29,977	13,944
Other electrical instruments	129,614	139,475
Electro-medical apparatus (not X-ray)	50,917	68,147
X-ray apparatus, other than tubes and valves	49,913	65,484
Vacuum tubes	50,377	65,769
Permanent magnets	38,638	50,814
Insulating cloth and tape	53,233	54,979
Other insulating materials	77,818	76,577
Unclassified electrical goods and apparatus	518,039	710,276
TOTAL, electrical goods and apparatus	8,747,316	9,760,238
Diesel driven generators, not exceeding 10 kW	276,221	143,535
Ditto, over 10 kW to 65 kW		102,564
Ditto, over 65 kW to 200 kW		134,184
Ditto, exceeding 200 kW	325,175	314,955
Other generating sets	114,569	79,043
Generators and parts of generators	617,160	600,411
Motors, railway, tramway and trolley-bus	7,757	7,765
Ditto, others not over ½ h.p.	115,225	200,353
Ditto, over ½ h.p. but under 1 h.p.	32,689	38,904
Ditto, from 1 h.p. to 250 h.p.	455,821	413,464
Ditto, exceeding 250 h.p.	138,473	77,976
Ditto, parts	113,592	148,526
Converting machinery	20,482	22,222
Transformers, including coils	1,047,464	1,121,020
Mercury arc rectifiers	51,766	103,999
Motor starting and controlling gear	250,806	259,583
Switchgear and switchboards (not telegraph and telephone)	1,360,439	1,465,779
Electrical machinery, n.e.s.†	416,673	66,118
TOTAL, electrical machinery	5,344,312	5,300,401
Washing machines (not exceeding 150 lb weight)*	268,251	366,076
Ditto (over 150 lb but not exceeding 250 lb weight)*		159,722
Ditto, parts	14,728	39,632
Vacuum cleaners	163,866	99,982
Ditto, parts	21,567	20,468
Other electrically operated portable appliances	175,362	221,288
Portable electrical tools	113,504	130,517
Electrical pottery and glassware, including insulators	91,287	72,609
Electrical conduit tubes and cased tubes	65,643	63,705
GRAND TOTAL	15,005,836	16,234,638

* Not separately distinguished in 1952.

† The two figures are not comparable.

TABLE II.—DISTRIBUTION OF ELECTRICAL GOODS AND APPARATUS

Destination	Nov., 1952	Nov., 1953	Destination	Nov., 1952	Nov., 1953	Destination	Nov., 1952	Nov., 1953
	£	£		£	£		£	£
Channel Islands ..	39,900	31,884	Other Commonwealth Countries	167,538	176,335	Syria	12,298	22,139
Gibraltar	6,727	3,372	Irish Republic ..	290,857	203,629	Lebanon	30,690	34,869
Malta and Gozo ..	9,240	28,163	Soviet Union ..	23,454	511,414	Israel	34,749	107,395
Cyprus	40,158	69,693	Finland	71,502	63,243	Egypt	98,980	90,858
Gold Coast	85,929	69,661	Sweden	237,906	353,599	Arabia	12,663	11,439
Nigeria	91,969	130,729	Norway	130,046	189,572	Iraq	166,370	115,690
Union of South Africa	950,357	604,788	Iceland	7,535	15,225	Iran	12,029	19,184
Northern Rhodesia ..	120,871	42,770	Denmark	80,854	95,437	Burma	73,531	134,738
Southern Rhodesia ..	113,658	89,908	Poland	14,667	73,007	Thailand	59,973	42,123
British East Africa ..	205,655	261,238	Western Germany ..	83,972	50,836	Indonesia	69,203	34,859
Bahrein, Qatar and Trucial Oman ..	48,543	45,497	Netherlands ..	273,823	296,041	China	6,069	37,648
Kuwait	61,186	88,549	Belgium	155,402	384,491	United States of America	144,400	118,987
India	928,097	637,058	France	83,069	206,431	Colombia	61,238	20,175
Pakistan	167,794	441,088	Switzerland	40,661	36,793	Venezuela	73,049	83,398
Malaya	357,287	304,696	Portugal	67,199	149,186	Peru	24,059	29,718
Ceylon	113,627	108,211	Spain	76,735	31,129	Chile	30,651	13,431
Hong Kong	132,773	87,018	Italy	125,831	296,984	Brazil	47,226	18,183
Australia	763,769	564,850	Austria	71,342	90,542	Uruguay	10,122	25,589
New Zealand ..	430,344	824,364	Czechoslovakia ..	3,229	4,354	Argentine Republic ..	22,782	220,445
Canada	287,298	421,783	Yugoslavia	13,831	33,514	Other Foreign Countries	331,257	277,889
British West Indies ..	103,085	94,100	Greece	65,021	22,886			
Anglo-Egyptian Sudan	70,827	48,024	Turkey	182,791	8,607	Total ..	8,747,316	9,760,238
			Portuguese East Africa	29,618	10,782			

and South Africa (£100,421), the latter also being the biggest buyer (£542,628) of " other electrical machinery."

Imports of electrical goods and apparatus rose in value from £624,693 in November, 1952, to £824,177 in November, 1953, the largest items being radio, telecommunication and electronic apparatus (£275,585) and valves (£256,990). Holland supplied £339,184 worth and the United States £149,884. Machinery imports included generators valued at £52,605 (£18,575), motors £28,090 (£29,553) and " all other sorts " £66,266 (£34,202).

External Trade Classification

New Pattern for 1954

By JOHN C. HANCOCK

A COMPREHENSIVE picture of world trade has always been difficult to obtain since the external trade statistics of one country, based on a system of strict individuality, have seldom followed a pattern common to any of its neighbours. Hence basic figures, even for identical industries as between one country and another, have evaded comparison especially as some countries have grouped their electrical products under a heading such as " Goods manufactured mainly of iron and steel." Certainly this grouping is no more illogical than the system followed by the United Kingdom in lumping together electrical and other kinds of machinery in the same group while maintaining at the same time a separate group for " electrical goods and apparatus."

In 1954 many of these international anomalies will disappear. As from to-day the United Kingdom, in common with a great many other member-states of the United Nations, will adopt the Standard International Trade Classification (S.I.T.C.) as the basic classification for external trade statistics and will thus acquire at last a separate electrical division which will embrace both machinery and goods and apparatus.

The accompanying table, reproduced from the official United Nations publication Statistical Papers Series M,

Class D. Division 16. **Electrical machinery, apparatus, and appliances**

Items Nos.

721–01 Electric generators and alternators, motors and convertors, transformers, switchgear.

721–02 Batteries (accumulators included in 721–19).

721–03 Bulbs, arc lamps, and tubes for electric lighting, complete.

721–04 Radio apparatus for telegraphy, telephony, television and radar (including broadcasting transmission and reception equipment with amplifiers of all types, thermionic or electronic tubes and valves, photo-electric cells, supersonic or electromagnetic echo sounding apparatus and detectors).

721–05 Apparatus (other than radio) for telegraphy and telephony.

721–06 Electrothermic apparatus (including domestic).

Items Nos.

721–07 Electrical appliances for motor vehicles, aircraft, ships, cycles, and explosion motors.

721–08 Apparatus for measuring and controlling electrical energy; electric signalling and safety apparatus; electric bells.

721–11 Electrical apparatus for medical purposes and radiological apparatus (not including tools and instruments merely actuated by electric motors).

721–12 Portable electrical tools and appliances (including domestic appliances).

721–13 Insulated cables and wire for electricity.

721–19 Electrical machinery, apparatus, and appliances, not elsewhere specified, and parts or accessories not assignable to a particular class of electrical machinery.

No. 10 (Second Edition), shows the main " international " items or " minimum list of commodities " in the electrical division for which comparative figures will be published in various United Nations and O.E.E.C. bulletins. The words in *italics* indicate the class and division under which electrical items will appear in the 1954 editions of the Export and Import Lists.

Even now some electrical items are divorced from their natural order. Electric light fixtures are included under the heading " Lighting fixtures of all materials (gas-light and electric light fixtures and fittings and parts thereof, lamps and lanterns) " and appear under the Division applicable to Prefabricated Buildings. Refrigerators are included under " Miscellaneous manufactured articles, n.e.s."

From to-day the United Kingdom Trade and Navigation figures will be arranged in the order of these main items *although the items as such are not reproduced in the new Export and Import Lists.* This means that existing headings, as shown in the 1953 Export and Import Lists, are retained as they stand, the effect being a rearrangement rather than a wholesale revision but with the advantage that the items are grouped in a more logical sequence. Similarly, all countries following the system will group their existing items in S.I.T.C. sequence so that aggregate values, comparable one country with another, will be available in respect of each of the " minimum " S.I.T.C. headings.

Each country will be allowed considerable latitude as to how it eventually subdivides the S.I.T.C. " minimum " headings, always provided that the single product, or group of products comprising the heading, is adequately covered. To take the first heading for instance: " Electric generators and alternators, motors and convertors, transformers, switchgear." The United Kingdom will continue to divide generators into the various ranges of output though some other country may wish to classify generators according to weight. Under the present United Kingdom export classification electric motors are divided in the first instance into two classes, namely " railway, tramway and trolley-bus " and " other," the " others " being broken down according to horse-power. Some other country, however, may prefer to classify electric motors merely according to weight or according to output in kW. This, of course, puts a limit on the extent to which " comparability " can be carried.

About a dozen countries, including the United Kingdom, are adopting the S.I.T.C. as their primary classification. Some thirty other nations, while not using the S.I.T.C. classification for domestic purposes, will supply trade figures based on the S.I.T.C. for United Nations and O.E.E.C. statistical bulletins. These countries include the United States, Canada, Western Germany, Sweden, Turkey, etc. Naturally those countries using the S.I.T.C. as their primary classification will the more easily be able to render to these bodies figures based on the international classification.

So far most British colonial territories have fallen into line with the United Kingdom and Canada in adopting the S.I.T.C. The other Dominions have not, but when they do agree (as it is expected most of them will eventually) to publish figures based on the new classification, an important step towards the study of Commonwealth and Sterling Area problems will have been taken.

So far as the United Kingdom is concerned, the adoption of the S.I.T.C. will enable us to avoid having to prepare special sets of figures for the various international bodies to which we belong, a process which involves considerable expenditure of time and effort on the part of the Statistical Division of H.M. Customs and Excise.

To give readers a glimpse of how electrical goods fit into the new classification: all exports and imports are grouped into five main classes, namely:—

Class A—Food, beverages and tobacco. Class B—Basic materials. Class C—Mineral fuel and lubricants. Class D—Manufactured goods. Class E—Miscellaneous.

Each of these classes is broken down into Divisions; for example, Class A contains separate divisions for live animals for food, meat and meat preparations, fruits and vegetables, and so on. Similarly Class D—manufactured goods—contains separate divisions, twenty-three all told, covering textiles, chemicals, manufactures of metals, machinery other than electrical and, of course, electrical machinery, apparatus and appliances. As already noted this Division within Class D is numbered 16.

One slight disadvantage which may show up in time is that statistics compiled on the basis of the new classification will not always be comparable with statistics of earlier years. However, the Customs announced some time ago that where possible they would endeavour to mitigate this drawback by re-working some of the past data on the basis of the new classification.

The adoption of the new classification has had the effect of " freezing," as it were, the 1953 headings in the Export and Import List. Naturally the major changes which are being brought into effect have entailed a great deal of work on the part of the Customs staff. This work would have been made even more complex had the Customs had, in addition, to carry out their annual review of the individual headings. Proposals for amending the existing nomenclature made by manufacturers or groups of manufacturers will now be considered by the Customs with a view to introducing them in the 1955 Export and Import Lists.

Festival Hall Heat Pump

PARTICULARS of components and performance of the heat pump installed by the Ministry of Fuel and Power at the Royal Festival Hall were given in a paper read before the Institute of Fuel on 22nd December by Messrs. P. E. Montagnon and A. L. Ruckley. Conditions were unusual in many ways. The original intention had been to provide hot water from gas-fired boilers, but in view of the cost of the fuel it was later decided to use a heat pump.

Centrifugal compressors were driven by two 350 h.p. Merlin aircraft engines and their design, together with the sealing of the driving shaft against refrigerant pressure, presented difficult problems of which the methods of solution were discussed. The output of the plant was 9 million B.Th.U./hr which was vastly in excess of average requirements, although the peak load had been initially estimated at 25 million B.Th.U./hr. For architectural and other reasons heating surfaces were minimized, the boiler water temperature allowed for being 180 deg F with a return temperature of 140 deg F which was unfavourable to heat pump working. Neither a steady load nor a long run could be achieved. It was concluded that, for the heat pump to show a financial saving, a load factor of at least 25 per cent would be necessary. The more satisfactory solution would be to make the heat pump a base load plant with some thermal storage; in the Festival Hall some summer cooling by chilled water was desirable and if the heat pump output were based on the refrigeration load nearly all the fuel saving would be a financial gain.

Fuel Efficiency

Coal, Gas or Electricity?

By Sir ARNOLD B. GRIDLEY, K.B.E., M.I.E.E., M.P.

OF all the necessities of life and for the comforts of home—next to food and clothing—none is more important to every householder than the services of the nationalized coal, gas and electricity industries. Each is vital in its respective sphere for industrial production, for transport, for public lighting, and for domestic purposes. If the supply of coal or electricity were for any reason to cease, practically all national activities would come to a full stop.

Yet in the recent debate on the latest annual reports of these three vital industries Parliament could only devote six and a half hours for discussion. Only a small part of a vast area could be covered in such an absurdly short time. What were some of the more important points all too briefly made?

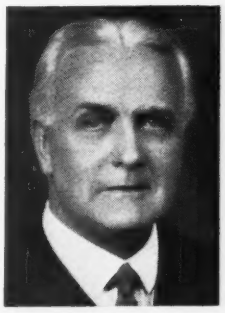
That insufficient coal is being mined to meet all home needs and for export.

That there is not enough of the right class of the larger coals to meet the needs of the gas industry or the domestic user.

That owing to increased mechanization of mines more and more small coal—slack, duff, slurry—is produced which is of little use for gas production or the home fire.

That the only possible efficient users of such coal are electric power stations, whose boiler house equipments are specially designed for its efficient utilization.

That by greater efficiency in its modern electric power generating plants the electricity supply industry is achieving an economy of no less than 1,000,000 tons of coal a year.



Sir Arnold Gridley

That notwithstanding the large additions of electric power station capacity lately brought into commission, the capital investment in this industry is still inadequate to meet all demands and needs to be at once increased. (An added reason is the fact that owing to inadequate expenditure on new plant in recent years, much existing plant—25 years old and more and therefore fuel-wasting—has still to be kept in operation.)

That the gas industry by the higher thermal efficiency in its new gas plants saved 400,000 tons of coal last year.

The conclusions to be drawn from the foregoing and other known facts are:—(*a*) That it is vitally necessary that coal should not be wastefully used by anyone. (*b*) That as electricity is provided by coal practically unusable elsewhere the maximum use of electricity should be encouraged, both industrially and domestically.

The writer holds no brief for the electricity supply industry to the disparagement of the gas industry. Each has its place in the national economy. But a cheap and abundant supply of electricity is vital to the industrial and domestic user. In my day, in developing electric power supply it was heresy not to make it well worth the while of industrial establishments to take the whole of their electrical requirements from the supply undertakings, whether company or municipal. It is a sad reflection that so many to-day have had to install a certain amount of stand-by generating plant of their own. But this became inevitable owing to the enforced limitation of expenditure by Governments on new power station construction by the B.E.A. However, this shortage is gradually being overtaken, though not rapidly enough.

It was pointed out in the recent debate that the load factor on the B.E.A. power stations was nearly 2 per cent lower in 1952 than in 1951. This means that from these power stations more electrical demands could have been met, especially during off-peak hours, than was in fact called for. In consequence there was not the same annual increase in energy sold by the Area Boards as was normal in earlier years. If this continues, the Boards' charges must be increased.

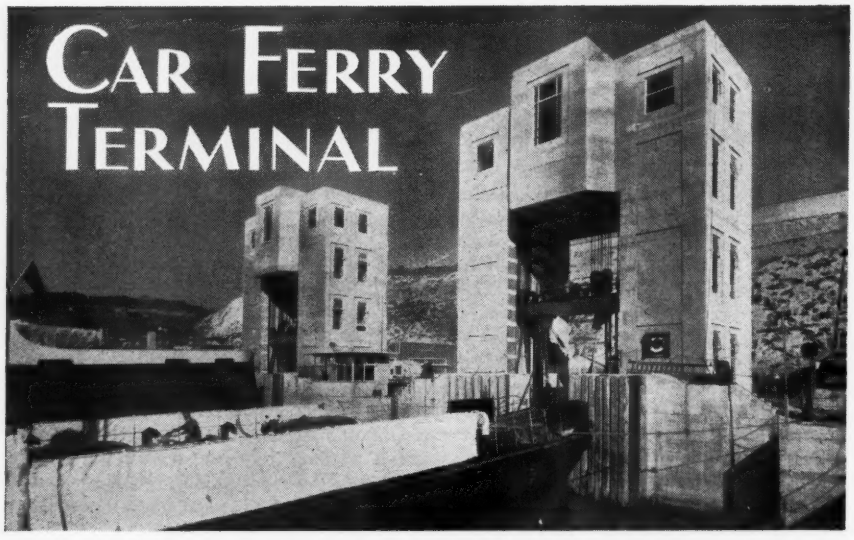
Now why has the normal growth of demand not been attained? Partly because there was a temporary recession of trade in the textile industry; partly because new business—especially domestic demand—was hampered by the continuing heavy purchase tax on domestic electrical appliances; by restrictions on hire-purchase and advertising (now happily and sensibly lifted); and last, but not least, by extravagant assertions by certain critics that electric immersion heaters are a menace, that electric cookers should be prohibited unless gas or coal are not available, that a 100 per cent tax should be levied on electric radiators and water heaters, and so on.

It is also frequently stated that the use of these appliances involves wastage of coal. How can that be when coal unsuitable for other purposes is used to provide the electricity to operate these domestic appliances? To limit or prohibit their use as is suggested by some would require restrictive legislation. This would hardly be consistent with "setting the people free."

Moreover, while it is true that there is still need for the careful use of electric cookers and space and water heaters during peak hours, their greatest use falls within off-peak hours. This becomes transparently clear when it is realized that the peak hours form 27½ hours per week, and taking 49 industrial working weeks in a year—allowance being made for festivals and two weeks annual works holidays—there are 1,350 peak hours and 7,410 off-peak hours in a year. In other words for about 83 per cent of the year the use of electricity for all domestic purposes can be freely encouraged. The Area Boards would then enjoy an improved load factor, augmented income, and lower costs per unit. This is what the B.E.A. and Area Boards want, and they are right.

There are many housewives who prefer to use solid fuel or gas, but thousands of others prefer electrical appliances. **Coal, gas and electricity all have service to render. All the unbiased can agree with the Ridley Committee that the consumer should have freedom of choice.**

Car Ferry Terminal



General view of portals with car ferry in position

Electrically Operated Loading Bridges Speed Up Traffic

LAST June the new car ferry terminal of the Dover Harbour Board was opened. Two new loading berths have been provided, with 21ft deep water at low water during ordinary spring tides. Each is 400ft long and 72ft wide and is designed to handle vessels between 300ft and 400ft long and between 35ft and 55ft beam.

For each loading berth a reinforced concrete portal tower has been constructed to house the suspension and operating machinery of a bridge that gives direct access between car ferry and shore. The bridges, each 140ft long and weighing 240 tons, are hinged at the land end and raised or lowered at the seaward end by electrically driven winches in the portals. The bridge is linked with the deck of the car ferry by a linkspan attached to the seaward end of the bridge and arranged for independent raising and lowering by a separate electric motor drive.

Automatic adjustment of the bridge level is achieved by a scheme using as a controlling factor variations in the angle of the linkspan with rise or fall of the tide. The linkspan actuates an arm which operates switches controlling the main bridge winch for adjusting the bridge level with tidal movements. The bridge levelling limit switches are in the end of the bridge and the operating arm projects out underneath the linkspan and is actuated by variations in the angle of the linkspan itself.

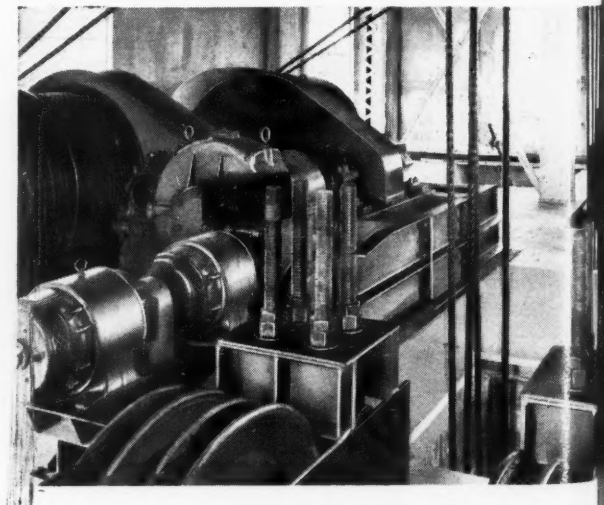
The adjustment of the bridge allows for ferries to be unloaded at all states of the normal tides and even with extreme tides loading can proceed provided that the deck is between 6ft and 18ft 6in above water level. The bridge is suspended by a cable system, the dead load being balanced by counterweights in the wings of each portal. The live load is carried by the main winch in the machine room at the top of the portal over the seaward end of the bridge.

The main winch and the linkspan winch for both bridges are operated from a control desk inside a cabin between the two portals. The bridge winch is driven through gearing by a 15 h.p. 1,420 r.p.m. slip-ring induction motor, which has a second motor directly coupled in tandem with it, not normally in service but immediately available in emergency by the operation of a changeover switch which connects the control gear from one motor to the other. The linkspan is raised or lowered by a winch on the cross-member by which the bridge is suspended. It is driven by a 5 h.p. slip-ring motor through a worm reduction unit.

The control scheme allows for manual control of the bridge when it is first being brought into position for vehicle transfer. After the bridge is approximately in the correct position, the linkspan is lowered on to the deck and the control changed over from manual to automatic. If, at this moment, the angle of the linkspan is incorrect, the bridge levelling limit switches will be in a position to initiate operation of the bridge winch to either raise or lower the bridge until the linkspan angle is correct. While the bridge is in service it remains under automatic control so that with every 3in variation in the tide level the bridge winch is operated to maintain the correct angle of the linkspan.

To provide electric power for the bridge machinery and for general power, lighting and heating requirements a substation was installed to take an incoming supply from the South Eastern Electricity Board at 6·6 kV and step it down to 415/240 V, three-phase, four-wire. In addition, the substation also contains two banks of mercury arc rectifiers to provide a d.c. shore-to-ship supply for car ferries when berthed.

Main bridge winch with tandem motor drive



The substation plant consists of a 6·6 kV three-unit Crompton Parkinson ALA1 switchboard for controlling an incoming feeder, the primary of a 475 kVA 6,600/415/240 V transformer, and the primary of a mercury arc rectifier transformer. Each unit is equipped with an oil circuit breaker of 150 MVA breaking capacity and a normal current rating of 600 A. The transformer output is controlled by one 800 A unit of a two unit "Klad" 415/240 V 4-wire switchboard, the second unit of which is rated at 400 A and controls the supply to five switch-fuse distribution boards for separate services to the land, "West" and "East" jetties, and for a crane and the two bridge portals. A three-phase cable has been installed to the end of the "West" jetty to meet future requirements for a shore-to-ship supply to vessels with a.c. electrical equipment.

Normally the mains supply is used for the motors operating the bridge machinery but in an emergency an alternative supply from a standby 37·5 kVA diesel alternator set is available.

The rectifier transformer supplies four glass-bulb units giving an output of 200 kW at 220/230 V d.c. The bulbs are mounted in pairs in sheet steel cubicles provided with automatically controlled fan cooling. They are equipped with grid control gear to give a rising output voltage characteristic from 220 V at light load to 230 V at full load. The rectifier output is fitted to a d.c. switchboard which controls two outgoing feeders to the "West" and "East" jetties respectively. These are arranged to provide alternative 50 kW power sockets for each of the two loading berths and similarly for each of two lay-by berths.

The terminal was designed by the Board's engineering staff under the chief engineer, Mr. J. W. Sutton, O.B.E., M.I.C.E., M.I.Mech.E., and the resident engineer, Mr. W. T. Allen, M.B.E., B.Sc.(Eng.), A.M.I.C.E., in conjunction with the architects to the Board, Messrs. J. M. Wilson, H. C. Mason & Partners.

Mears Bros. (Contractors), Ltd., were the main civil engineering contractors. M. B. Wild & Co., Ltd., were the main contractors for the bridge hoisting machinery, which was erected by Brown & Aitken Engineering Co., Ltd. The electrical installation was carried out by Crompton Parkinson, Ltd., who also supplied h.v. and m.v. switchgear, transformers, cables, machinery drives and controls. Allen West & Co., Ltd., supplied the control gear; David Brown-Jackson, Ltd., and David Wiseman & Co., Ltd., reduction gearing; Nevelin Electric Co., Ltd., mercury arc rectifier units; and Petbow, Ltd., the standby alternator set. Palmers Hebburn Co., Ltd., constructed the steel bridges and linkspans.

Medium-voltage switchgear, rectifier unit, and d.c. switchboard for shore-to-ship supply

NEW BOOKS

Commonwealth Stocktaking. By L. St. Clare Grondona. (389 pp.; 22 plates). Butterworths Publications, Ltd., 88, Kingsway, London, W.C.2. Price 35s.

It is the author's aim, as expressed in his preface, to present within the limitations of one volume a comprehensive summary in correlated form of the resources, production and external trade of the Commonwealth countries in foodstuffs and a wide range of raw materials. Mr. Grondona has succeeded in his aim very well, having regard to his need for compression and condensation.

Among the raw materials with which the book deals are several classes which interest the electrical industry—copper, tin, aluminium, lead and rubber. Present and future output and requirements are succinctly dealt with and some interesting conclusions are drawn, e.g., that there is no physical reason why, given the finance, the Sterling Area should not produce and refine as much copper as it needs.

A chapter on fuel and power includes a brief survey of electricity production and consumption in the principal Commonwealth countries and references are made to some of the important power development schemes now under way. Appended to this section is a two-page note on electronics which, though interesting, is perhaps a little alien to the remainder of the book.

On the whole the work is a good general conspectus of a very important subject and it is well indexed.—J.H.C.

BOOKS RECEIVED

Mechanical Vibration. By G. W. van Santen. Pp. 296; figs. 216; index. Philips Technical Library. Cleaver-Hume Press, Ltd., 42a, South Audley Street, London, W.1. Price 35s.

Data and Circuits of Television Receiver Valves. By J. Jager. Pp. 216; figs. and index. Philips Technical Library. Cleaver-Hume Press, Ltd. Price 21s.

Statistical Methods in Electrical Engineering. By D. A. Bell, M.A., B.Sc. (Oxon), Ph.D., M.I.E.E. Pp. 175; figs. and index. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 25s.

Materials for the Electrical Industry

Production, Consumption and Prices

IN this annual review the Metal Information Bureau, Ltd., has compiled for us a record of factors affecting the production and prices of the principal materials used by electrical manufacturers.

IRON AND STEEL : The year 1953 proved a notable one for the British iron and steel industry. The most spectacular event was the attainment of new records in the production of both pig iron and steel. In November the annual rates were 11,883,000 tons and 18,878,000 tons respectively, and although the final figures will not be known until well into January, there is little doubt that the target of 17,500,000 tons of raw steel was attained. Pig iron output lagged a little until the end of the year, but greatly expanded production is expected in 1954. The past year saw the coming into operation of a large amount of new and modern iron and steel making equipment.

The greatly increased steel production has now banished almost entirely the steel shortage which was so persistent in 1951 and 1952. There is still not really enough plate steel available, but increased domestic production and imports have eased the position considerably. The general steel allocation scheme, which came in for a good deal of criticism, was ended on 6th May. A voluntary allocation system for plates had been brought in a little earlier.

There is a heavy home demand for almost every steel product, and the rail, plate, sheet and heavy section mills are all active. The export trade has become more difficult during the year because of growing foreign competition, but British exports have been more or less maintained at last year's level. Re-rollers of bars and light sections have been hardest hit. Despite sharp export price cuts, their prices are still above Continental ideas and, with a home demand that leaves something to be desired, they are unable to work a full week. Tube and wire mills have also begun to feel the pinch, mainly owing to shortage of export orders. Light castings foundries, which have been short of work for most of the year, have enjoyed slightly better conditions in the last quarter.

Home iron and steel prices manifested little change during 1953. Some slight advances were made earlier in the year to take into account higher coal prices and there were some adjustments for deliveries to certain areas. On 8th December the Iron and Steel Board set up under the Iron and Steel Act, 1953, took over the responsibility for fixing maximum home trade prices from the Ministry of Supply, but made no important changes. A number of products were released from price control during the year including wire, cold-drawn tubes, forgings, railway axles, pit props and colliery arches.

The denationalization of the iron and steel industry is proceeding and already several companies have been sold.

COPPER: The year 1953 opened with rather a slack demand in Britain for items of semi-manufactured copper and there is little doubt that in the Midlands works managements were viewing the outlook with some concern. Intake of raw copper had fallen away because of the quiet demand for products and the Government—at that time still the sole seller of copper to industry—was unable to dispose of all the metal available to it under its contracts with the Empire producers. United Kingdom stocks continued to rise and the Government offered no objection to the Rhodesian producers selling certain surplus tonnages abroad. Conversely, in America the demand remained substantial, providing a strong bolster to world prices.

By April, however, the world supply position in copper had become so much easier that various price reductions were noted; the British Ministry of Materials had renegotiated its purchasing price with the Empire producers and on 25th April was quoting £253 a ton, against the £285 a ton at which it was selling at the beginning of the year. There was growing talk on the desirability for re-opening the London Metal Exchange for free trading in copper and it was subsequently decided to take this step with effect from 5th August: on that date prices were quoted around £215 a ton for cash copper and £200 a ton for three months' delivery, although subsequent dealings resulted in prices maintaining a good deal of basic stability. The market remained short of prompt metal and the Government Broker, who sat in the ring to assist the market where necessary so far as supplies were concerned, made various sales from time to time.

Meanwhile, it cannot be said that consumer demand for copper was particularly impressive; world supplies presented no difficulty and many anticipated steady declines in prices. Much expansion had been taking place throughout the world on the producing side, while there was also a growing accumulation of copper in Chile following a refusal of buyers, notably in America, to pay the high price asked by that country. By the end of November Chile was believed to have accumulated about 140,000 tons of copper—apart from a monthly output of fully 30,000 tons—and negotiations with America were proceeding regarding possible purchase.

During the first ten months of 1953 United Kingdom consumption of copper, by uses, was made up as follows (in long tons):—

Copper Content	January–October	
	1952	1953
	tons	tons
UNALLOYED COPPER PRODUCTS:		
Wire	160,025	116,628
Rods, bars and sections	11,875	10,118
Sheet, strip and plate	47,390	35,211
Tubes	38,587	30,266
Castings and miscellaneous	5,000	5,000
ALLOYED COPPER PRODUCTS:		
Wire	10,649	7,020
Rods, bars and sections	67,852	47,107
Sheet, strip and plate	76,616	58,033
Tubes	11,074	10,139
Castings and miscellaneous	44,868	32,388
Copper sulphate	12,280	9,643
Total	486,216	361,553

(Source: British Bureau of Non-Ferrous Metal Statistics.)

LEAD : London Metal Exchange prices for lead, fo current month delivery, stood at around £104 a ton at th beginning of the year; subsequent day-to-day fluctuation occurred but during the next month or two the genera tendency was downwards. From May onwards the tren was for prices to rise although by the year-end the bette levels achieved earlier had been lost.

In general, the demand for lead in the United Kingdom was disappointing during the early months of the year although spot supplies remained rather scarce, largely as a result of a strike at the big Australian smelter at Port Pirie, which normally supplies a large portion of United Kingdom requirements. The demand for lead-containing products was anything but impressive and this was naturally reflected in the call for pig lead. Buying by consumers tended to be on a rather hand-to-mouth basis for prompt delivery, the uncertain outlook limiting interest in forward lead to a considerable degree. The weakness in London found sympathy in the American market, where the opening months of the year had witnessed a good sustained demand for lead, and there continued to be voices raised for the institution of some form of sliding-scale tariff on lead imports since, it was claimed, producers in America were being forced to restrict output.

The second half of the year saw some steady improvement in the demand for lead in America although in the United Kingdom interest still continued to be to a large extent centred on nearby supplies with the result that prompt lead continued to command premiums over forward, thereby limiting the value of the London market as a hedging medium.

The achievement of the Government's housing target for 1953 together with the greater freedom to be permitted in building, domestic, industrial and agricultural, during 1954 is expected to have a beneficial effect on the demand for lead products. The United Kingdom consumption of lead, by trades, was as follows:—

Trade	January–October	
	1952	1953
	tons	tons
Cable making	88,400	76,628
Battery (excluding oxides)	22,133	23,075
Oxides and compounds:		
Battery	17,493	19,150
Other uses	20,615	24,951
White lead	6,349	9,082
Sheet and pipe	50,308	58,593
Shot	3,573	3,762
Foil and collapsible tubes	2,489	2,573
Solder	8,662	8,645
All other alloys	9,538	9,792
Miscellaneous	12,708	13,562
Total consumption	242,268	249,813

(Source: British Bureau of Non-Ferrous Metal Statistics.)

TIN: Monthly average prices per ton for cash tin (mean of buyers' and sellers' prices) during the first eleven months of 1953 are given below as an indication of the trend of tin prices during the year:—

January	£957 5s 6d	July	£598 12s 5d
February	£965 15s 9d	August	£598 11s 6d
March	£948 7s 9d	September	£612 13s 5d
April	£760 12s 6d	October	£615 2s 1d
May	£740 17s 6d	November	£635 1s 2d
June	£687 4s 3d		

(Based on London Metal Exchange daily prices.)

The past year witnessed fluctuating conditions in tin and prices in London and the East varied appreciably, sometimes from trading session to trading session. In general, the year was split by the Korean armistice; before this prices were maintained at a high level and after it the better political atmosphere and hopes of stability in the East resulted in prices declining sharply. It cannot be said that consuming demand in any of the major tin using countries was impressive and there is little doubt that users viewed the supply and price outlook for tin with a good deal of uncertainty.

It became apparent during the year that the United States' stockpile was well on the way to completion with the result that the market looked as though it was going to become top-heavy with a burdensome surplus. Production was running ahead of consumption and there was growing talk of the need for some form of international control which would limit production and exports, confine the price within an agreed range and institute a buffer stock which would buy and sell tin in order to stabilize the market.

Declining prices had the effect of closing a number of the small mines in the Far East where producers continued to cite high production and other costs as necessitating the maintenance of selling prices at levels which some consumers, notably America, regarded as excessive. On 16th November representatives of producing and consuming countries met in Geneva to discuss the possibility of formulating an international agreement. After some three weeks of talks an agreement was drafted, the text being taken back by delegates for consideration and approval by the various Governments. The most interesting feature of the draft was that it was theoretically possible for an International Tin Agreement to come into force without ratification by the United States (the world's largest consumer of tin). Signing of the agreement can take place in London between March and June this year.

ZINC: Imports of slab (unwrought) zinc into the United Kingdom during the first ten months of 1953 totalled 109,610 tons, thereby recording a notable reduction from the 194,696 tons imported during the same period of 1952: a substantial reduction was noted in arrivals from dollar countries.

The London Metal Exchange re-opened for free trading in zinc on 2nd January, 1953, after having been closed since 1939, when the Government took over the importation, distribution and price fixing of zinc and other commodities: the Government's selling price of good ordinary brands of zinc on 1st January was £110 a ton whereas current month prices on the Metal Exchange on 2nd January were £95½–£96 a ton, although due allowance has to be made for the fact that the Government's quotation was on a delivered-to-consumer basis, the market price being ex-ship. In general, no difficulty attached to the acquisition of supplies and the year opened with consumers adopting a cautious purchasing policy.

This cautious attitude was apparent pretty well throughout the year since, with the trade outlook uncertain, users were loth to commit themselves more than necessary and kept new buying on a rather hand-to-mouth basis.

The brass trade experienced very dull conditions for a number of months during the year and this naturally affected the demand for zinc; fortunately, the galvanizing trade kept up a sustained demand and in the main the die-casters also were buyers. The decision to re-open the London Metal Exchange for free trading in copper raised hopes that cheaper copper and zinc would result in a growing demand for the latter from the brass makers and there can be little doubt that the closing months of 1953 did in fact see a growing consumer demand for zinc, although for some of the earlier months the offtake was rather disappointing. The bulk of interest was centred on early delivery metal with the result that this commanded a premium over forward; nor did a Government announcement about the middle of the year regarding disposal of surplus stocks have much effect on the price since it was all along felt that official policy was not to unload supplies on to the market in substantial quantities.

The declining price of zinc on the London and international markets resulted in producers in the United States clamouring for the introduction of some form of

sliding-scale tariff on zinc and zinc product imports: many mines of a marginal nature had been forced to close. Demand for zinc for a good part of the year was unimpressive and by the year-end substantial stocks had been accumulated. Consumption in the United Kingdom during the first ten months, by trades, was as follows:—

Trade	January–October	
	1952	1953
	tons	tons
Brass	94,396	68,201
Galvanizing	57,287	72,911
Rolled zinc	14,624	16,950
Zinc oxide	15,799	19,275
Zinc alloy die-casting	19,825	20,371
Zinc dust	5,239	7,054
Miscellaneous	10,608	10,737
Total all trades	217,778	215,499

ALUMINIUM : Consumers in Britain were obtaining reasonable supplies of virgin aluminium through the Government at the beginning of 1953; it cannot be said, however, that the demand for aluminium and aluminium alloy products was particularly impressive. Manufacturers of semi-fabricated items found it necessary to push the sale of their products in the face of growing competition from other materials and a good deal of redundancy was apparent, even at big well-established manufacturing plants.

On 1st April the British Government reduced its selling price of virgin ingot by £5 to £161 a ton as a result of an improvement in the Canadian dollar-sterling exchange rate, but demand was poor, especially since an early return to free trading in aluminium was looked for. The return to private trade in the metal became a fact on 1st July; at the same time this country's main supplier, the Aluminum Co. of Canada, announced a reduction in its selling price to £150 a ton. It was agreed that the British Government would take up surplus supplies in the event of sales by Canada to British industry falling below a certain level.

In America wage increases and other factors resulted in price rises and there is no doubt that British consuming industry was competitively placed from a world market point of view, both as to supply and price. Meanwhile, vast expansion schemes are being undertaken in various parts of the world with the result that aluminium productive capacity has increased substantially.

RUBBER : The intention of the United States Government to submit to Congress before 31st January, 1955, a plan for the disposal of its synthetic rubber plants to private industry led to much speculation about the future supply and price of synthetic rubbers, although it was not expected that this withdrawal would impair the competitive position of the natural product. There is no doubt that in the United Kingdom the greater availability of synthetic rubber would be welcomed; in some quarters the view is taken that as a result of the great technical advances made synthetic rubber has become a competitive necessity. For rubber 1952–53 was a difficult transitional period: while a large part of British industry experienced a general decline the fall in the rubber trade, assessed by consumption, was more severe.

Although some consideration was given by Indonesia to the export of rubber to Communist China the view remained that there was good reason for an embargo and this was observed. During the year there was much talk of a possible restriction of production and efforts were made to stabilize prices by international agreement. Meanwhile, the American Government has decided to give serious consideration to a review of its natural rubber programme.

Rural Electrification "School"

MEMBERS of the staffs of every Electricity Board in England, Scotland and Wales (except London) and of the Electricity Board for Northern Ireland and the Eire Electricity Board, will attend a three-day "school" on rural electrification matters at the University of Nottingham School of Agriculture, Sutton Bonington, near Loughborough, Leicestershire, from 4th to 6th January. The course, which has been organized by the British Electrical Development Association, was arranged because of the impetus given to electrical development work in rural areas by the Government's decision to authorize the Electricity Boards to increase their capital expenditure on bringing electricity to country districts, and because of the contribution electricity can make to greater agricultural productivity. So great was the response that it was found necessary to restrict the delegation from each Board. There will be 120 delegates who will reside at the school, and the course will also be attended by fifteen day delegates, representatives from P.E.N., Holland, A.P.E.L., France, the National Agricultural Advisory Service and of Farm Institutes.

The course will be opened by Mr. V. W. Dale, general manager and secretary of E.D.A. The first address will be on "Rural Electrification To-day," by Mr. C. R. King, chairman, East Midlands Electricity Board, who is chairman of the E.D.A. Rural Electrification Advisory Committee. He will be followed by Mr. C. A. Cameron Brown, agricultural electrification adviser, British Electricity Authority, who will speak on "Selling More Units of Electricity in the Rural Areas." On Monday afternoon, Mr. J. D. Ivins, lecturer in agriculture at Sutton Bonington, will deal with agricultural education in Great Britain and, after the "students" have toured the school's farm buildings and dairy, he will also speak about education at Sutton Bonington. In the evening a paper on "Application of Electricity to Farming" will be given by Mr. E. C. Claydon, South Eastern Electricity Board.

On Tuesday morning a paper on "The Practical 'Know-How' of Electric Steam Raising and Hot Water" will be given by Mr. P. Wakeford of the British Electricity Authority. In the afternoon Mr. M. M. Harvey, agricultural engineer, Midlands Electricity Board, will speak on "Selling Electric Steam Raising and Hot Water to the Farmer." The farmer's viewpoint will be given to the students in the evening by Mr. L. L. Perkins, who is chairman of the East Midlands Electricity Consultative Committee.

On Wednesday morning Mr. J. T. Taylor (Bournemouth Sub-Area, Southern Electricity Board) will speak on "Selling and Installing Grain Drying Plant," and Mr. W. L. Hearle (agricultural engineer, North Western Electricity Board) on "Getting the Best Results from Barn Hay Drying." After lunch Mr. J. I. Bernard, chief technical officer E.D.A., will give the concluding address.

VIEWS on the NEWS

By REFLECTOR

WITH the advent of 1954 I thought I would see what the *Electrical Review* was saying in January, 1874—eighty years ago. First there was a report of a series of tests by the Count du Moncel on bichromate batteries followed by an article on the electro-deposition of tin and a description of Siemens's universal galvanometer. This instrument was said to be designed for measuring electrical resistances, comparing electromotive forces and measuring the intensity of a current. The incorporated resistances were measured in " Siemens's units "; although in 1865 a British Association Committee had recommended the use of a " B.A. ohm " it was not until after 1893 that the " international ohm " became generally accepted. The Siemens unit (largely used on the Continent) was about 94 per cent of the international ohm. It is noteworthy, however, that in another article in this issue of the *Electrical Review* (by H. R. Kempe) on the measurement of resistances the term ohms (without qualification) was used. The list of new patents included in this issue was headed by one for " The application of electricity to horses and cattle suffering from local, chronic and constitutional ailments and diseases, with all necessary appendages for applying the same." It seemed to consist in applying metal plates to various parts of the animal's body and sending a current of electricity through " thereby producing beneficial effects."

There are many other interesting points in this eighty-year-old number but I must defer further reference to them until a later issue.

* * *

Too often, unfortunately, there are reports of wild birds fouling overhead lines and meeting their death, incidentally causing power stoppages. It is pleasing, therefore, to hear that electricity has another side so far as these creatures are concerned. I hear from the Midlands Electricity Board that it has run an 11 kV line to Slimbridge, Gloucestershire, where the Severn Wildfowl Trust has one of the world's largest bird research stations. The power thus provided will be used for a number of purposes. Electric incubators and brooders will help the Trust to improve on its remarkable achievements in the breeding of rare waterfowl and a pump-operated artificial waterfall is to be created to provide a home for some specimens of Harlequin ducks from Iceland, Mountain ducks (New Zealand) and Torrent ducks which live in the turbulent mountain streams of the Andes. Artificial lighting will be used to persuade the Brent goose, which normally broods in the long arctic daylight hours, to breed in this country. A rather less cheerful application will be the use of refrigerators in which deceased birds can be kept pending post-mortem examination to ascertain the causes of death.

* * *

Unusual and unexpected applications of electrical apparatus always fascinate me. Farmers in Nottinghamshire I hear, are now using their television sets in their " war " against poultry thieves. When the television programme is finished the sets are kept switched on at their maximum strength and, even if the raiders are considerate enough to fit suppressors, the cars they use to carry away the " swag " produce slight flashes on the screens. Following the same lines as the burglar who now uses a watchdog, the next move of the poultry thief who wishes to keep abreast of the times will probably be the adoption of radar for detecting both the birds and the approaching farmer.

* * *

It is a testimonial to the broadmindedness of electricity authorities (contrary to an impression fostered by rivals) that a young woman employed by the North Eastern Electricity Board was able to win a gas cooking competition without detriment to her position. The *Northern Echo* (Darlington) reports:—

> " She was not as enthusiastic as one would have expected when she was announced the winner—she was more than a little worried about the reaction of her employers to her entering the competition of a rival concern. But after discussion between officials of both boards her fears were dispelled and she was told that she could go to work on Monday without any misgivings."

* * *

Whenever I suggest that there is a need for a particular piece of electrical apparatus I am nearly always informed that such an appliance is already on the market. I will, however, take a chance and put forward a plea for an electric dry shaver which incorporates a small lamp to illuminate the face. At home the problem does not arise to any extent: one can generally fix up fairly easily simultaneous supplies both for the shaver and a lamp. But in a hotel the choice is often one or the other and in any case, even if there are two lighting points available, the light is nearly always in the wrong place. The additional weight involved in providing the built-in lamp need not be great.

* * *

Apropos the recent reduction in prices of certain domestic electrical appliances the *News Chronicle* makes the suggestion that with every piece of apparatus a civil little note should be enclosed saying: " Please—as much as you can, will you keep to off-peak hours? " No one will disagree with the idea, the implementation of which is to the advantage of all, but it should perhaps be pointed out that many of the appliances are normally used at off-peak periods and that it is by the extension of the use of electricity to the widest possible number of applications that the highest load factor can be achieved and the generating stations run most efficiently.

* * *

Dealing with the difficulties of some television set owners in all parts of the world in obtaining adequate reception, *Aluminium News* (Montreal) says:—

> " No such problem arises in the area of Portland (Oregon) . . . because many inhabitants of this area were progressive enough in the past to equip their buildings with aluminium roofs. Consequently, they now simply point their aluminium antennas at the aluminium roofs to receive a reflected but strong signal."

I doubt whether this gets over the problem of distance from a transmitter. And is the " reflected but strong " signal unaffected by passing automobiles?

PERSONAL AND SOCIAL

News of Men and Women of the Industry

THE Minister of Fuel and Power has reappointed **Dr. P. Dunsheath,** C.B.E., M.A., M.Inst.C.E., M.I.E.E., F.Inst.P., and **Mr. G. C. R. Eley,** C.B.E., M.A., as part-time members of the London Electricity Board. **Mr. W. J. H. Wood,** M.I.E.E., M.I.Mech.E., is retiring on completion of his term of office. **Mr. E. A. Mills,** M.I.C.E., M.I.E.E., M.I.Mech.E., who, as already announced, relinquished the deputy chairmanship of the Board on 31st December, will remain on the Board as a part-time member.

Captain J. M. Donaldson, M.C., F.C.G.I., M.I.C.E., M.I.E.E., St. Albans, and **Mr. W. J. Humphreys,** Barking, have retired from the Eastern Electricity Board on completion of their terms of office, and **Sir Cecil Oakes,** C.B.E., J.P., D.L., Woodbridge, Suffolk, has been reappointed as a part-time member.

Col. T. F. Hood, O.B.E., T.D., D.L., F.C.A., Newton St. Loe, near Bath, has been appointed a part-time member of the South Western Electricity Board.

Mr. R. W. McCrone, M.C., B.Sc. (Eng.), A.M.I.C.E., and **Sir Ronald Thomson,** D.L., have been reappointed part-time members of the South East Scotland Electricity Board and **Mr. G. K. Paton,** M.I.E.E., has been appointed a part-time member of the Merseyside and North Wales Electricity Board. **Sir Arthur Pickup** retired from the Board on completion of his term of office on 31st December.

Mr. W. J. Henton-Jones, D.S.O., R.D., A.M.I.Mech.E., M.I.Mar.E., deputy superintendent at Kearsley power station, has been appointed

Mr. W. J. Henton-Jones

superintendent at Agecroft H.P. station of the North Western Division, British Electricity Authority.

Mr. Henton-Jones, who was educated at the Bridgend Grammar School, South Wales, received his technical training at Cardiff Technical College, and served his apprenticeship with Hills' Dry Docks & Engineering Co., Cardiff. From 1929 to 1938 he served at the Radcliffe power station as shift charge engineer, and later as deputy resident engineer. During the 1914–18 war he served as second lieutenant R.F.C., and later became pilot officer. In 1939 he was mobilized as lt.-commander (E) R.N.R. and was later promoted to the rank of commander and was mentioned in despatches in April, 1941. In June of the next year he was awarded the D.S.O. From 1946 he continued his service as shift charge engineer at Kearsley, and in 1948 was appointed deputy superintendent to Mr. W. Jackson.

Col. B. H. Leeson, director of the British Electrical and Allied Manufacturers' Association, has been nominated to represent the Institution of Electrical Engineers on the General Board of the National Physical Laboratory in succession to Sir Vincent de Ferranti, whose term of office expired on 31st December.

Lord Bennett, C.B.E., having completed a year in office as chairman of the British Productivity Council, has been succeeded by **Mr. Tom Williamson,** C.B.E. **Sir Lincoln Evans,** C.B.E., has been succeeded as deputy chairman by **Sir Ewart Smith.** Lord Bennett, who will remain a member of the Council, is joint managing director of Joseph Lucas, Ltd., and a past-president of the Federation of British Industries. Mr. Williamson is general secretary of the National Union of General and Municipal Workers. Sir Lincoln Evans, who earlier this year was appointed vice-chairman of the Iron and Steel Board, has resigned from the Council on relinquishing the appointment of general secretary of the Iron and Steel Trades Confederation. Sir Ewart Smith is technical director of Imperial Chemical Industries, Limited.

Sir Andrew Naesmith, C.B.E., who was also appointed to the Iron and Steel Board and who retired recently as secretary of the Amalgamated Weavers' Association, has also resigned. The following have been nominated by the T.U.C. to fill the consequent vacancies: **Mr. W. L. Heywood,** O.B.E., general secretary, National Union of Dyers, Bleachers and Textile Workers, and **Mr. L. T. Wright,** general secretary, Amalgamated Weavers' Association.

Mr. S. Smith, second assistant engineer, transmission department, North Eastern Division of the British Electricity Authority, has been appointed senior assistant engineer. Before serving with the Division, Mr. Smith was with the North Eastern Electricity Board and also the former North Eastern Electric Supply Co., Ltd., having joined the staff of the latter after serving an apprenticeship with Metropolitan-Vickers.

H.M. the King of Sweden has conferred upon **Mr. James Scrivener,** whose name has been so long associated

Mr. J. Scrivener

with Electrolux, Ltd., the Order of Vasa (First Class) for his work in furthering Anglo-Swedish trade relations.

Mr. L. W. H. Rea, B.Sc.(Eng.), who was recently appointed general manager of Edwin Danks & Co. (Oldbury), Ltd., has been elected to the board of directors, following the resignation of Capt. (E) Gregson, R.N.R. **Mr. W. Smith,** works manager, has also been elected a director, in place of Mr. J. W. Hargreaves, who has also resigned.

Mr. G. C. B. Everard, district manager at Horsham for the South Eastern Electricity Board, has been appointed manager of the Hastings District of the Board. Mr. Everard served as a pupil with the Hereford Corporation, with whom he continued as mains engineer. Later he was with the Gloucester Corporation as generating station engineer, and joined the Horsham electricity undertaking in 1929 as mains superintendent, subsequently becoming deputy chief engineer (in 1944) and chief engineer and manager (in 1946). He was appointed to his position with the South Eastern Board on nationalization of the industry. During the 1914–18 war he served as a pilot with the R.F.C. and the R.A.F.

Mr. L. J. Simmons, M.I.E.E., A.M.I.I.A., a senior assistant engineer at the Mid-Sussex Area headquarters, Brighton, succeeds Mr. Everard at Horsham. After training with the Brighton Corporation, he held various positions in the electricity undertaking up to first assistant distribution engineer. For a short period he was with the Willesden electricity undertaking, but returned to Brighton in 1948 when he took up his present appointment.

Mr. C. W. Cosgrove, B.Sc.(Eng.), has been appointed to succeed **Mr. E. R. Gant** as general manager of the Osram–G.E.C. group of factories. Mr.

Cosgrove joined the M.O. Valve Co., Ltd., an associated company of the G.E.C., in 1922 to found a development laboratory. He was appointed assistant works manager of the M.O. Valve Co. in 1940 and ten years later became works manager. In 1951 he was appointed assistant general manager of the Osram–G.E.C. group of factories and of the M.O. Valve Co., Ltd.

Mr. Gant, who retired at the end of October, joined the Robertson Lamp Works of the G.E.C. in 1910, and in 1918, while still only twenty-five years of age, was appointed a superintendent in the Osram–G.E.C. Lamp Works, Hammersmith. Twelve years later (in 1930), he became assistant manager of the M.O. Valve Co., Ltd., and in 1940 was appointed general manager of the Osram–G.E.C. group of factories.

The B.B.C. announces the appointment of **Mr. L. Evans** as engineer-in-charge of the low-power television transmitting station near Douglas, Isle of Man. Mr. Evans joined the B.B.C. in 1941 and has served at a number of the Corporation's sound and television transmitting stations. He saw service with the Royal Corps of Signals from 1943–46. He was transferred to the B.B.C. television transmitting station at Sutton Coldfield in 1949 and to the television transmitting station at Wenvoe in 1952.

Lord Merrivale, President of the Institute of Traffic Administration, visited Manchester recently and was received by the Lord Mayor. They spent some time together talking about Manchester's traffic problems. Later in the day Lord Merrivale visited **Ferranti, Ltd.,** Hollinwood, and made a tour of the transformer and meter factories. Ferranti, Ltd., are concerned with traffic problems of a special nature, involving the use of heavy trailers carrying transformers. Special routing arrangements required for Ferranti large power transformers were explained by Mr. H. Brown, head of the Ferranti Transformer Dispatch and Packing Department.

W. T. Henley's Telegraph Works Co., Ltd., has announced the following retirements and appointments as from to-day (Friday):—**Mr. F. W. M. Anderson,** director and general manager, retires from the position of general manager, after forty-seven years with the company. He remains a director, and is retained for special consultation. **Mr. G. E. Rhodes** retires from the position of deputy general manager after fifty years with the company. **Mr. E. J. Vidler,** the present assistant general manager, is appointed general manager, and **Mr. F. V. Vaissiere,** the present general sales manager, is appointed assistant general manager.

Professor Emrys Williams, B.Eng., Ph.D., M.I.E.E., Professor of Electrical Engineering at the University College of North Wales, Bangor, has been appointed the first Professor of Electrical Engineering at the University College of South Wales and Monmouthshire, Cardiff. Professor Williams was educated at Liverpool University and from 1934 to 1937 was a member of the scientific staff at the Wembley Laboratories of the General Electric Co., Ltd. From 1937 to 1947 he was lecturer in electrical engineering at King's College, University of Durham, and in the last mentioned year took up his present position at Bangor. He was chairman of the Radio and Measurements Group of the North Eastern Centre of the Institution of Electrical Engineers for 1946–47.

Mr. W. M. Gore, charge engineer at Southport power station, has been appointed operation and efficiency engineer at St. Helens power station and takes up duty on 18th January. Mr. Gore has been in the electricity supply industry for nearly thirty-eight years and was previously at the Atherton station, and with the Bradford Corporation, the Lancashire Electric Power Co., and the Manchester Corporation.

Mr. F. W. M. Anderson *Mr. G. E. Rhodes*

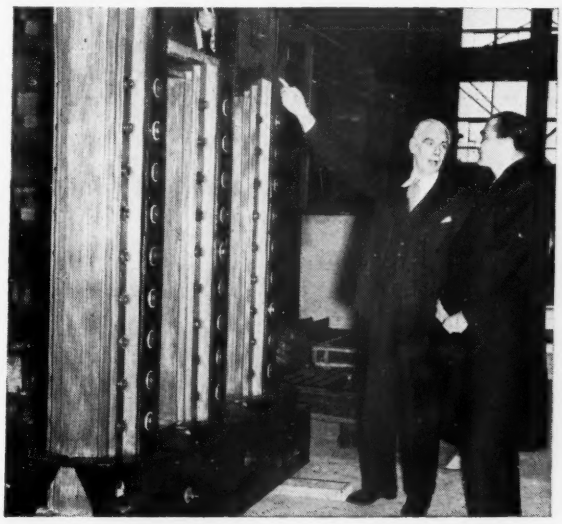
Mr. F. V. Vaissiere *Mr. E. J. Vidler*

Mr. D. A. Green, A.C.A., F.C.I.S., at present secretary of the Surrey Sub-Area of the South Eastern Electricity Board has been appointed section head in the Secretary's Department at the Board's headquarters. **Mr. L. H. Kemp,** A.I.M.T.A., at present assistant accountant at the Board's Surrey Sub-Area, becomes secretary of the Surrey Sub-Area.

About 300 people attended the Connaught Rooms, London, on 21st December, when the staff association of **Johnson & Phillips, Ltd.,** held its ninth annual dinner and dance. Speeches were made by the chairman and joint managing director of J. & P., Mr. G. Leslie Wates, J.P., and the association's chairman, Mr. W. F. Smith, and a programme of cabaret and dancing followed.

Over 300 children of the employees of the **Britannic Electric Cable & Construction Co., Ltd.,** Iver, Bucks, attended the annual Christmas party, given on 19th December at the company's canteen by the directors and management. The children were delighted with an excellent stage show followed by high tea and the appearance of Father Christmas, who gave a present to each child. Proceeds of an auction by the managing director, Mr. H. W. Bowen, O.B.E., of a cake and a box of chocolates were forwarded to the Electrical Industries Benevolent Association.

The annual dinner of the Sports and Social Club of the Banbury District of the **Midlands Electricity Board** was held on 19th December at the Crown Hotel, Banbury. Mr. C. Young, district engineer, presided, and Mr. J. H. Davis, district manager, in proposing the toast of the visitors, said that the Board would welcome



Mr. O. M. Robson (left), general sales manager, Ferranti, Ltd., explaining to Lord Merrivale the core construction of a transformer at the new transformer factory, Hollinwood

industrial development. It had the plant and the equipment to cope with any development that might come its way. During the evening, Mr. D. H. Kendon, deputy chairman of the Board and president of the Club, presented long service awards to seven employees.

About 200 children attended a party in the works canteen of **Marconi Instruments, Ltd.,** Longacres, St. Albans, on 19th December. The party was organized by the company's Social and Sports Club Committee and the children were entertained with a Punch and Judy show, a display of dancing, and a film show. Gifts were distributed by Mr. Jon Ebbs as Santa Claus.

Simms Motor Units, Ltd., entertained managers from sixteen of its home branches at its annual branch managers' dinner at Hendon Hall recently. Mr. G. E. Liardet, chairman and managing director, attended, together with Mr. J. Ayres, Mr. G. J. Rackham and Mr. W. Bryan (directors).

The annual Christmas dance of **Asea Electric, Ltd.,** was held on 18th December at the Walthamstow Assembly Hall, when Mr. H. V. Pointon, managing director, presented suitably engraved wristlet watches and long-service certificates to a further fourteen employees who have completed twenty-five years' service.

A dinner/smoker held recently at the Windsor Castle Hotel, Victoria, S.W.1, by the members of the **Electrical Trades' Commercial Travellers' Association** and their guests, was attended by over 200. The toast of the Association, given by Mr. V. P. Crow, a vice-president, was replied to by the president, Mr. T. B. O. Kerr, other speakers being Messrs. Cowell, R. C. Twitchin, F. N. Woods, and the chairman, Mr. E. J. Shuter.

OBITUARY

Mr. A. Aspinall.—The death has taken place at the age of seventy-three of Mr. Amos Aspinall who had spent the whole of his life in the electricity supply industry. At the age of twenty he was appointed borough electrical engineer at Brighouse, Yorks, and remained head of the Corporation electricity undertaking for forty-six years, retiring shortly before the nationalization of the industry.

Mr. S. H. Heywood.—The death occurred early in December, at the age of eighty-five, of Mr. S. H. Heywood, founder and chairman of S. H. Heywood & Co., Ltd. It was largely as a result of Mr. Heywood's pioneering of electric blocks that the organization attained its present position as a leading manufacturer of electric cranes. Originally the company traded from Manchester only, where its electrical contracting activities continue, but a factory was built at Reddish early in the century. This produced motors and switchgear; and later electric lifting gear became the main product. Since that date Mr. Heywood had managed the Reddish works. He was also a director for many years of B. R. Rowland & Co., Ltd. He commenced his engineering career as an apprentice electrician with the Edison Swan Co.

Mr. William Griggs, the first member of the staff of the General Electric Co., Ltd., to be engaged by

The late Mr. W. Griggs

Mr. Hugo Hirst (later Baron Hirst of Witton) when the company was formed, died on 21st December at the age of eighty-nine. He retired in 1932 after fifty years' service. Two succeeding generations of his family now serve the G.E.C., a son in Magnet House, Kingsway, and a grandson in India.

Mr. R. W. Kennedy.—We regret to record the death of Mr. Ralph William Kennedy, late editor of the *Electrical Contractor*, which occurred on 17th December in his seventy-second year. Mr. Kennedy started his journalistic career as a sub-editor of *Electrical Industries* in 1905. During the 1914–18 war he was deputy inspector of non-metallic materials with the Air Ministry. He joined the E.C.A. in 1926, and was editor of its journal for twenty-four years until his retirement in 1950.

Mr. J. E. Hodgkin.—The death occurred on 26th December at Bishop Auckland of Mr. J. E. Hodgkin, R.B.A., F.S.A. Mr. Hodgkin, who was seventy-eight, was prominent in the electrical industry in the early days. He served an apprenticeship with Ernest Scott & Mountain, Ltd., and afterwards set up in practice for himself. Apart from his electrical activities, Mr. Hodgkin was an amateur archæologist of note.

Mr. John Marshall, managing director of R. E. & C. Marshall, Ltd., electrical contractors, Cheltenham, died on 20th December at the age of seventy-one.

WILLS

Mr. J. G. Linford, formerly manager of the Newmarket Electric Light Co., who died on 30th May, left £4,990 gross (£4,871 net).

Mr. C. Curwen, managing director of Buchanan & Curwen, Ltd., who died on 26th August, left £4,627 gross (£4,536 net).

Printing Works Fatality

A SHORT-CIRCUIT in an electric lamp over a type-setting machine in the works of the Brentwood Gazette, Ltd., killed Eric Reginald Ives, 27-year-old compositor of Woodman Road, Brentwood, Essex. The firm was held to have failed to comply with the Factories Act requirement that the lamp be properly earthed and was fined £50 with 2s 6d costs. Mr. John May, appearing for the company, which pleaded not guilty to the summons, contended that if the court found the lamp to be defective and to contravene the Factories Act, the blame lay on the Eastern Electricity Board against whom his clients were laying an information summons. Mr. Hugh Griffiths, for the E.E.B., pleaded not guilty to this summons.

Mr. R. H. Thompson, District Inspector of Factories, suggested that even if the Board did install the lamp, it was the prime responsibility of the company, as the occupier of the factory, to ensure that the metalwork of the fitting was earthed. Mr. F. Clarke, Electrical Inspector of Factories, said the fitting had been connected by means of two-core light duty flex to the ceiling rose through a system of pulleys and counterweights. He did not consider it to have been done satisfactorily. It was essential, with the voltage used (240 V), for the lamp to be efficiently earthed. The flex had been damaged at the point of entry into the lamp. It would have been a simple matter to provide a three-core flex, which he thought should have been used especially as there was a system of pulleys and counterweights. He agreed that it would be reasonable for the company to have relied on the Board carrying out a proper, effective and efficient job on the installation.

Mr. Griffiths told the court that he had not received any instructions regarding the socket and asked for an adjournment in order that he could visit the *Gazette* works and inspect it. He added that he would not call witnesses because "there was going to be a big civil action about this."

Summing up after the adjournment had been granted, Mr. May said that the Board was the guilty party in failing to observe the Act. It was responsible for any negligence or wrongdoing on the part of its electrician. He said the job had been done most incompetently and the lack of inspection or testing on the part of the employee was a sad commentary on the way he had done his work.

Mr. Griffiths said that the company should have noticed that something was wrong and taken steps to right it. It had countenanced the fault and done nothing about it.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Tubular Transmission Line Towers

IN your issue of 18th December your correspondent Mr. A. E. Percivall shows a lively interest in the article produced in your issue dated 6th November, and raises some pertinent questions.

The decision to test our tower in Italy was taken only after very full consideration of the testing facilities available in this country. The British testing equipment was quite unable to cater for the full height of tower which we considered desirable and, even with a reduced height, results could not be produced in the limited time we had at our disposal.

Facilities were not offered to expert personnel from the various British authorities since the test was viewed at this particular stage as being purely a private matter to supply us with sufficient technical data to enable us to go forward with confidence to these authorities for a final proving test in this country. It can be taken for granted that in any future tests all interested parties, particularly from the B.E.A., will be welcomed.

Mr. Percivall, who obviously is an expert in transmission line work, concedes in his letter that previous efforts to produce a high voltage transmission line tower of tubular construction have not been successful, and admits that the major problem has been hot-dip galvanizing after fabrication. It is curious, therefore, to find him maintaining that "the object was to galvanize the tubes both internally and externally and so guarantee complete protection."

Open-ended tube gives no weight advantage whatsoever to tubular construction since this material is subject to corrosion from both surfaces, and consequently comes under the minimum thickness regulation normally laid down in tower specifications of the usual rolled section construction.

Sealing of all tubes is a fundamental principle in tubular construction because no internal corrosion can occur in the absence of free oxygen; therefore the major problem in tower work is devising a method whereby a sealed tube can be effectively hot-dip galvanized. We claim to have solved this problem by a method which overcomes the danger of explosion in the bath and consequent risk to operators. For obvious reasons, the parts of the tower tested in Italy were not hot galvanized, but the hot-dip galvanizing process has been thoroughly tried out on sealed tubular tower members.

In regard to the test on the tower, only the actual working loads and 1·55 times the broken earth-wire loads were applied, as it was considered that since we were only checking our design basis the results from these tests would provide us with sufficient information to enable us to assess accurately the other load applications. The acme of tower design is the design of a structure which under any one of the five loading conditions mentioned by Mr. Percivall would fail at the prescribed loading factor. Therefore, to do a test properly five towers would be necessary and it would be interesting to learn if the tower now in use, to which he refers, was tested in this way. We feel that the tests we have carried out to date have proved that our design methods are sound and that we are now in a position to proceed with the design and testing of a tower unit to fulfil the requirements of the authorities.

It is appreciated that little commercial value can be attached to a tower of this nature unless it can be supplied and erected at a lower cost than its predecessors. "The proof of the pudding is in the eating," and we are confident that with the inherent advantages of tubular construction, the methods of fabrication now at our disposal, the successful solution of the galvanizing problem, and the technical knowledge we have gained from our investigation, we are now in a position to put forward an economic proposition. The fact that the export market has become one of intense competition should, we feel, only act as an incentive to British firms to take up the challenge with this new and formidable line of attack.

London, S.W.1.

E. McMINN,
Chief Engineer,
Tubewrights, Ltd.

Training within Industry

IS T.W.I. a success or not, and how can it be assessed in the electricity supply industry?

Recent comments in the Press by two members of a "District Employment Committee" who have taken the course stated that T.W.I. is ridiculed by the supervisory staffs who thought it was a waste of public money and ridiculous for a person who had been in a supervisory capacity for 24 years to be told how to do his job. If supervisors could find ways of saving wasted hours they would of course do it.

So far as could be seen, it simply put into logical form practices which were taking place all day long in any organized factory.

L.E.D.

Electric or Electrical?

I AM somewhat surprised that "Reflector" finds it "difficult to justify the employment of both adjectives" —electric and electrical—"save by usage. . . ." Surely usage is adequate justification, and that there is a distinction in usage cannot be denied. Fowler makes this quite clear, pointing out that "the difference between the 'electric book' that gives one shocks and the 'electrical book' that improves one's knowledge of science is obvious." Substitute "Review" for "book" and the point is brought well home.

An "electric engineer" might be a live wire, but not necessarily an electrical engineer.

J. A. STEDMAN, M.A.,
Education Officer,
British Electrical Development Association.
London, W.C.2.

B.E.P.C. Exhibition

MR. V. W. DALE, general manager and secretary of the British Electrical Development Association, tells us that a limited amount of space will again be available at the British Electrical Power Convention exhibition for firms who are not members of any of the associations represented on the Convention Council. The exhibition will be held at Eastbourne from 14th to 18th June. Applications for space should be sent to Mr. Dale, at 2, Savoy Hill, London, W.C.2, by 15th January.

Brazil's Investment Policy

From Our Rio Correspondent

IN reply to a question by the Brazilian Bank for Economic Development, as to how requests by foreign companies for financial assistance should be dealt with, President Vargas replied that such requests should be examined in accordance with the general rules adopted by the Bank, without discriminating between foreign and national capital. As resources were limited, enterprises should first endeavour to raise capital in the private investment market. The Bank should not, however, neglect opportunities for participating directly in the capital of foreign companies.

These requests for assistance were made by the Brazilian Traction, Light & Power Co. and the American Foreign Power Co. As regards the first-named, the Bank's *Service Bulletin* had previously published the following note: "This company has undertaken a vast scheme to expand its power, gas and telephone services, to be spread over ten years. The expenditure is estimated at an astronomical figure ($U.S. 1,200 million), 75 per cent being destined to increase electrical capacity in the Federal District and Sao Paulo. On completion of the important undertakings, now in an advanced stage of construction, work will be speeded up on the thermal station at Piratininga and the underground hydraulic plant at Cubatao, for which equipment has already been ordered. Consumers' needs are expected to reach 2,000,000 kW by 1954 and, in order to satisfy them, the company is raising a loan in Canada and has asked the Bank for Economic Development to assist. . . . The Brazilian Traction plans to transform its subsidiaries into local companies. The Sao Paulo Light should be converted early in 1954 and the Brazilian Telephone Co. will be similarly dealt with by splitting up the telephone companies of Sao Paulo, Minas Geraes, Federal District and State of Rio de Janeiro. . . . The value of the company's investments in Brazil exceeds $U.S. 700 million."

The first of a series of six new 35,000 kW generators was inaugurated at the Fontes power station in October. The others will be installed during 1954.

The Minister of Agriculture, who grants concessions to exploit water power, has submitted a memorandum to President Vargas, in which he estimates that an expenditure of 16,000 million cruzeiros (£320 million) will be needed to make good Brazil's actual power shortage of 1,600,000 kW. He urges the Government to introduce less severe laws so that capital may be attracted to the industry, which is one of the least remunerative of industrial activities.

The Brazilian Bank for Economic Development has granted a loan of 200 million cruzeiros (£4,000,000) to the Minas Geraes Central Electric Co. (CEMIG). This concern, founded in 1952, is a mixed economy enterprise, in which 51 per cent of the shares are held by the State Government. Its function is the direction of a group of subsidiaries, including Middle and Upper Rio Doce and the Upper Rio Grande Electricity Companies. These three subsidiaries, in which CEMIG holds the majority of shares, are building and operating stations at Tronqueiras (10,000 h.p.), Santo Antonio (150,000 h.p.), Itutinga (50,000 h.p.) and Piaui (25,000 h.p.). The total cost of construction is estimated at £20 million.

Three other regional companies are being formed under CEMIG's control to feed other parts of the State. In addition, the capacity of two existing plants is being raised by 15,000 h.p. each and the equivalent of £320,000 has been advanced to two municipalities to increase their capacity. The State Assembly has voted an "economic recovery tax," yielding £360,000 monthly, part of which is used to defray the cost of new power stations; the World Bank has advanced $US 7,300,000 and the Federal Government is granting exemption of customs duties on imported materials.

At present 92 per cent of the energy consumed in Minas Geraes is derived from wood and charcoal, seriously depleting forest reserves, and only 3 per cent of the available hydraulic power is utilized. In 1940 installed capacity amounted to only 144,647 kW and this was distributed among 371 hydro-electric and 52 thermal stations. Development of the State's mineral and vegetable resources, among the most important in Brazil, has been retarded by inadequate electricity supply and transportation systems. These deficiencies are now being rapidly overcome. Installed capacity will be raised from 250,000 kW in 1951, to 600,000 kW in 1955, municipal and private enterprises contributing 100,000 kW.

Since the above notes on the Brazilian Government's investment policy were received from our Rio de Janeiro Correspondent there has been a statement on the subject by the President of Brazil. Sr. Vargas accused foreign interests of action prejudicial to the country's electric power policy. The high cost and scarcity of power were slowing down industrial development and the vast water-power resources should be properly exploited. The Government was proposing to set up a new power company, on similar lines to its petroleum undertaking, to combat adverse foreign influence. Unless the country itself could provide the necessary capital to place the national power industry on a firm foundation it might be necessary to nationalize foreign concerns.

The President's remarks were followed by a statement by Mr. H. Borden, president of the Brazilian Traction, Light & Power Co. Mr. Borden did not think that there had been any threat to those power companies in Brazil which had done their best to fulfil their obligations and to increase their facilities to meet the ever-rising demand upon them.

I.E.E. Benevolent Fund

AN appeal has been made by Mr. H. Bishop, President of the Institution of Electrical Engineers, on behalf of the Benevolent and Homes Funds. Mr. Bishop says that the Benevolent Fund has the greatest difficulty in making ends meet. Last year the fund paid out £280 more than it received in donations and subscriptions, and he is anxious that this drain on its resources should not continue. The average contribution per member is at present about 6s 4d (a disappointing figure).

On "The Chesters" Estate at New Malden, Surrey, given by a member in 1944, sixteen houses have been built and these are occupied by members or their dependants. To complete the development of the Estate some £35,000 is still wanted.

Mr. Bishop asks members to support either of these funds by a single contribution or, better still, by a covenanted subscription.

Plant for Canada

A CONTRACT worth more than $1,500,000 (£530,000 sterling) has been received by the Metropolitan-Vickers Electrical Export Co., Ltd., from the Calgary Power Co., Canada. The contract was obtained in face of competition from Germany, Switzerland and America, as well as other British companies. It covers the supply of a 66 MW, 3,600 r.p.m. steam turbo-generating set which is the largest ever ordered for Canada. The set will consist of a two-cylinder turbine operating with inlet steam conditions of 1,250 lb/sq in gauge, 950 deg F, and a 13,800 V a.c. generator of the hydrogen-cooled type. It will be the initial generating unit in a new power station to be built by the Calgary Power Co., at Wabamun, near Edmonton, Alberta.

Engineering Wages Dispute

At a meeting on 23rd December of the Confederation of Shipbuilding and Engineering Unions it was decided to impose a complete ban on overtime in the engineering industry and reductions in piecework as from 18th January. Unsuccessful attempts were made by the two general unions with members in the engineering industry to secure a ballot on the question and, as an alternative, to submit the claim for a 15 per cent increase to arbitration.

The Minister of Labour and National Service saw employers' and workers' representatives on 23rd December and arranged to meet them again this week in an endeavour to persuade them to resume negotiations.

Synthetic Rubber Imports

The Board of Trade announces that licences to import synthetic rubber in small quantities from dollar sources for general use and on the home market will be considered for the period ending 30th June. Previously licences have been issued only for defence needs and export orders. Details are given in Notice to Importers No. 617 issued on 22nd December.

Inspection of Appliances in Australia

A Bill to "protect Western Australia from being the dumping ground for cheaply-made and below-standard electrical appliances" recently came before the Legislative Assembly. The Bill is designed to give the State Electricity Commission power to inspect electrical apparatus, and to pass or reject it. The *West Australian* comments that in normal circumstances, and with sensible buying by the public, there seems no strong reason why unsafe appliances made by unknown manufacturers should enjoy a wide sale. The electrical appliance trade is a competitive one, and there is no lack of a variety of reliable makes from reputable firms.

Power Farming Conference

At the Town Hall, Cheltenham, on 9th, 10th and 11th February, farmers and agricultural engineers from all over the country are meeting to discuss their mutual problems at the 4th National Power Farming Conference. Subjects to be debated will include current research in electricity on the farm; agricultural engineering practice in Germany; grain handling and storage; hill farming machinery; and land drainage. In all cases the needs of the smaller to average size farms will be covered as well as those of the larger units. The Conference will include a civic reception and dance given by the Mayor of Cheltenham, and a Conference dinner. Admission is free by ticket, and hotel accommodation will be booked on behalf of visitors by the organizer. Applications for programmes should be made, at an early date, to the Organizer, *Power Farmer*, Dorset House, Stamford Street, London, S.E.1, from whom all details can be obtained.

Switchgear for Greece

The Public Power Corporation of Greece (Electric Power Division) has awarded Line Equipment, Ltd., a contract for over 3,400 expulsion fuse switches, to a value of approximately $56,000. This order has been obtained against strong American, Italian and German competition, and Mr. P. H. Jackson, sales director of the company, visited Greece recently to settle details concerning the contract.

Magnesium Decontrolled

The Minister of Supply has made the Magnesium Distribution (Revocation) Order, 1953 (S.I. 1953 No. 1850) which, from to-day, 1st January, removes all control on the acquisition, disposal, treatment, use and consumption of virgin magnesium and virgin magnesium alloys; as from to-day, private trading in magnesium is restored.

Naval Electrical Trophy

An "efficiency" trophy provided by H.M.S. *Ariel*—ship's name of the Royal Naval School of Air Electrics—for annual competition amongst the five R.N.V.R. Air Divisions, has been won in its inaugural year by the Electrical Section of the Northern Air Division which operates at the R.N. Air Station, Stretton, near Warrington. The trophy will be presented to the Division on 31st January by Vice-Admiral A. K. Scott-Moncrieff, C.B., C.B.E., D.S.O. (and Bar), R.N., the Admiral Commanding Reserves. It is a fitting reward for sustained keenness over the past year by the Division's Electrical Training Officer, Lieut.-Cdr. (L) G. Jones, Associate I.E.E., R.N.V.R., and his team.

It is perhaps not generally known amongst young men who have taken up "electrics" as a career and who have yet to do their National Service, that by joining one of the R.N.V.R. Air Divisions they can be guaranteed similar work in the Fleet Air Arm during their compulsory service. In this way they can avoid a two years' break in their electrical studies and, if suitably qualified can obtain commissions whilst serving. The types of aircraft operated by the R.N.V.R. Air Squadrons are Sea Furies and Fireflies, both petrol driven. This year jet engines will be available and opportunities for lectures and practical work on their electrical equipment will be provided for trainees.

Fuel and Power Statistics

The Ministry of Fuel and Power's "Statistical Digest 1952" (H.M. Stationery Office, 21s) contains 153 tables dealing with coal, electricity and gas production and consumption, the petroleum industry, etc. The 34 electricity tables give a great deal of useful information on such matters as the number and size of generating stations, plant capacity, electricity generated, maximum demand and load factor, fuel used, works costs, thermal efficiency, employment, capital expenditure, consumers and sales. A table of supply voltages at consumers' terminals shows that out of a total of 13·7 million consumers in 1951 the number supplied at the standard voltage of 240 V was 4·5 million; at 230 V, 5·9 million; at 200 V, 1·5 million; and at other voltages from 100 to 250 V, 1·3 million; the remainder received a supply at higher voltages. D.c. consumers numbered 659,379. The total number of persons employed in the electricity supply industry in 1951 was 180,793 (against 175,655 in 1950). Of these 119,802 (118,159) were operatives, 59,365 (56,086) administrative, technical and clerical staff and 1,626 (1,410) canteen, etc., employees.

New House Journal

We have received from Lancashire Dynamo Group Publicity Services a copy of the first issue of *Electricity in Industry*, the new house journal of Lancashire Dynamo Holdings, Ltd. In a foreword Mr. H. W. Bosworth, chairman, Lancashire Dynamo Holdings, Ltd., says: "This is the first

issue of a technical review which will be published at regular intervals. The aim behind this project is to be as informative as possible on a variety of topics relating to the ever increasing use of electricity in industry. It is intended that in this and in subsequent issues some of the problems which are encountered in the manufacturing world shall be discussed and the methods by which they have been overcome will be described. It is hoped also from time to time to provide information about the actual methods of production used in various engineering works." The principal articles are "Industrial Electronic Equipment," by R. J. F. Howard, Lancashire Dynamo Electronic Products, Ltd.; "The Development of a New Type of Mercury Arc Power Rectifier," by K. B. Blake, B.Sc. (Eng.), A.M.I.E.E., Nevelin Electric Co., Ltd.; "Totally-enclosed Closed-Air-Circuit Machines with Water Cooling," by P. Huggins, A.M.I.E.E., Lancashire Dynamo & Crypto, Ltd.; "Selenium Rectification," by J. Bushnell, Crypton Equipment, Ltd.; and "High Accuracy Current Transformers," by R. E. Jennings, A.M.I.E.E., Foster Transformers, Ltd.

Prizes for Apprentices

Registered building apprentices, recommended through regional Joint Apprenticeship Committees, are again being awarded prizes by the Building Apprenticeship and Training Council for outstanding work during the year. Some 460 apprentices will receive prizes totalling about £600. Of particular interest this year is the participation in the scheme for the first time of apprentices in the electrical contracting industry; thirty boys will receive prizes to a total value of £60. Prize-winners are recommended to choose suitable books on subjects connected with the industry. Arrangements for the presentation of prizes to successful candidates at suitable functions are made by the various regional Joint Apprenticeship Committees or Technical Colleges. Presentations will take place early in the New Year.

The successful electrical apprentices are as follows, with the employers' names in parentheses:—

R. Bacon (H. E. Williams & Co., Ltd.), K. F. J. Ballard (Electric Contracts, Ltd.), G. Bell (Frankish & Bell), K. H. Blowers (Mann, Egerton & Co., Ltd.), R. Borley (B. C. Bullard & Co.), R. Bowsher (Dicks, Ltd.), K. F. Collier (Haywards, Ltd.), K. Crosby (F. Shepherd & Son, Ltd.), F. E. Eastment (Electrical Services, Ltd.), D. A. Gardner (Rugby Electrical Eng. Services, Ltd.), B. Goddard (Reading Co-operative Society, Ltd.), H. Greaves (F. G. Mount), C. J. Green (G. E. Taylor & Co., Ltd.), K. Green (T. W. Broadbent, Ltd.), T. W. Hanson (T. Clarke & Co., Ltd.), J. Hawkings (Shoolbred Electrical Co., Ltd.), E. H. Hill (Atkins & Evans), A. J. Hobbs (Engineering Services Installations, Ltd.), D. Howe (S. Charlesworth & Co., Ltd.), M. E. Lawford (Meggitt, Marsh & Co., Ltd.), B. Matcham (R. J. Bullivant & Son), D. Mellor (R. Hardy, Ltd.), R. A. Parkes (R. E. Saunders, Ltd.), T. Rowlands (Wilsons Brewery, Ltd.), M. J. Setterington (G. E. Taylor & Co., Ltd.), M. W. Simkins (G. E. Taylor & Co., Ltd.), J. R. Smith (S. W. Bligh, Ltd.), T. K. Townsend (W. Horsfall, Ltd.), J. Watts (L. E. Clifford, Ltd.), and G. B. Woolston (Dale Electric, Ltd.).

Socket Used as Coat Peg

A Lithuanian workman who used a lamp socket as a coat peg was killed when removing the coat it was stated at a Birmingham inquest. The jury returned a verdict of "Accidental death." Mr. R. A. West, a director of West's Wire Mills, Ltd., Ladywood, said that a lamp had been installed to show whether power to a sawdust machine was on or off, as in the past the power had been left on. He had never known the socket for the lamp to be used for hanging clothes. There were pegs for that purpose. There was no bulb in the holder at the time of the accident, and it appeared the live pin had been touched. The casing was not alive when it was tested after the accident.

Control Gear Exhibition

Following its programme of private exhibitions of motor control gear all over the United Kingdom, Arrow Electric Switches, Ltd., recently concluded the second of the series at the St. Enoch Hotel, Glasgow. The exhibition was organized by Mr. McQueen, the company's Scottish representative, and there was a large attendance of electrical engineers and buyers.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM Ingots	ton £150 os od
COPPER, H.C. Electro	ton £232 os od
Fire Refined 99·70%	ton £231 os od
Fire Refined 99·50%	ton £230 os od
COPPER Tubes	lb 2s 2½d
Sheet	ton £286 10s od
H.C. wire and strip	ton £259 10s od
LEAD, English	ton £89 os od
Foreign	ton £88 os od
MERCURY	flask £61 15s od
TIN, block (English)	ton £645 os od
ZINC, G.O.B. Foreign	ton £74 os od
Electrolytic	ton £75 os od
BRASS Tubes (solid drawn)	lb 1s 9½d
Sheet	ton £233 15s od
Wire	lb 2s 5d
PHOSPHOR BRONZE Wire	lb 3s 7½d
PLATINUM	oz £27 os od
RUBBER, No. 1 R.S.S. spot	lb 17⅛d–17⅜d

E.I.B.A. Northern Counties Area

The annual general meeting of the Northern Counties Area of the Electrical Industries Benevolent Association will be held on 14th January at 3 p.m. in the Lecture Theatre, Carliol House, Newcastle-upon-Tyne, under the chairmanship of Mr. W. R. Gledson.

Educational

A short course of six lectures on "Electronics Instruments," will be held at South East London Technical College, Lewisham Way, S.E.4, commencing on 26th January, and a further course of six lectures on "Automatic Process Control" will commence on 9th March. The fee for each course is £1, and applications should be made to the head of the Department of Electrical Engineering.

"Wade's Tables"

A new edition of "Wade's Tables" is now available from Gabriel, Wade & English, Ltd., Southam Chambers, Waltham Street, Hull (5s). This classic collection of data on the design and characteristics of wood-pole supports for overhead lines first appeared in 1907; the last edition was in 1944. The contents cover stayed and unstayed single poles and composite structures such as the "A," "H," "Rutter" and "Portal" types. It is noted in the introduction that practically 95 per cent of wood-pole lines now employ single poles.

The revised edition coincides with the issue of B.S. 1990 : 1953 relating to wood poles for overhead lines which supersedes B.S. 139 and 513 for red fir and European larch poles.

Examples of Packaging

The method of packaging can play an important part in selling electrical apparatus and in the accompanying pictures we show two distinctive examples.

The English Electric Co., Ltd., has designed an attractive label for packaging its plate warmers. The dominant colour is lichen green with black and white for the illustrations of chinaware and silver which indicate the functions of the plate warmer in the home. The label also serves as a simple counter-display unit for dealers where more elaborate shop dressing is not available.

The new cartons now being used for packing "Ediswan" electrical accessories and "Clix" radio components, solve the problem of providing a distinctive pack for a range of literally dozens of different components without the need for stocking large quantities of many different kinds of cartons. The basis of the scheme is a series of rigid boxes each of a size suitable for 6, 12, 24 or more switches, switch-sockets or other accessories. These boxes are printed with a distinctive all-over design combining the trade name "Ediswan" with an "electric flash" motif in white on a red background. Accessories packs bear an "Ediswan" blue label over-printed in black while the radio components packs are distinguished by a cream and black label.

Cartons for "Ediswan" accessories and "Clix" radio components and (right) English Electric plate warmer packaging

The catalogue numbers, description and quantity of the products contained in each pack are shown in black on a white panel on the label. The "Ediswan" and "electric flash" design is also used on gummed sealing tape used for sealing parcels of accessories or components dispatched in bulk.

Change of Address

The London office of the Electricity Trust of South Australia is now 12, Queen Anne's Gate, S.W.1.

Calendars

W. J. Webster, Ltd., has chosen a daily calendar, mounted on a neat board, which can be either hung from the wall or placed upon the desk.

Monthly tear-off sheets form the calendar of Allen & Pope, Ltd., above which are illustrations of the company's lighting fittings.

"Turtle Doves" is the title of the picture which adorns the calendar of the Lindley Thompson Transformer & Service Co., Ltd.

The calendar of the Liverpool Electric Cable Co., Ltd., has a picture of Speke Hall, Liverpool. The three-monthly slips show the preceding and following months.

Sheldrakes in flight make an attractive picture for the calendar received from Milne & Longbottom, Ltd.

The calendar of Permali, Ltd., has the twelve months on a single sheet.

A picture of the Coronation drive is the subject for the calendar of the London Electric Wire Co. & Smiths, Ltd., which has daily slips.

Francis Polden & Co., Ltd., have sent us an "At-a-Glance" calendar which has monthly sheets.

Trade Announcements

The **Stella Lamp Co., Ltd.,** has appointed Mr. J. Biggs as its representative in Lancashire, and Mr. K. V. Issott to represent it in Yorkshire.

Bill Switchgear, Ltd., has formed a new company, Bill Switchplugs, Ltd., to handle the increased demand for electrical accessories. This company will operate from an independent factory at Victoria Road, Aston, Birmingham. The sales organization will still be handled by Bill Switchgear, Ltd.

Measurement, Ltd., announces that due to the expansion of the electricity business of the Remote Control Division at Kennington and the meter business at Tameside Works, it has been decided to direct the combined sales organizations from the Kennington Works. As from to-day (Friday) all correspondence concerning electrical products should be addressed to the company's Electrical Division, 7-17, Fitzalan Street, Kennington, London, S.E.11 (telephone: Reliance 2406).

Mr. S. H. Denby who for many years has been the London and Home Counties representative for the **Anglo-American Vulcanized Fibre Co., Ltd.,** has been appointed Midland representative in succession to Mr. L. Wright.

Catalogues and Lists

Metway Electrical Industries, Ltd., King Street, Brighton, 1.—Priced leaflet on "Metalicway," a new galvanized steel flexible metallic armouring; and illustrated priced catalogue of "Silvaway" weatherproof lighting fittings.

Midland Silicones, Ltd., 19, Upper Brook Street, London, W.1.—Leaflet entitled "Where to Buy Products Made from Silastomer," a complete list of "Silastomer" silicone rubber processors.

Fenton, Byrn & Co., Ltd., Airflow Works, Berrylands Road, Surbiton, Surrey. —Loose-leaf catalogue illustrating a range of "Air-Flow" industrial and domestic fans and unit heaters.

J. E. Baty & Co., Ltd., 39, Victoria Street, London, S.W.1.—Illustrated priced catalogue of dial gauges and precision measuring instruments.

Wallace & Tiernan, Ltd., Power Road, London, W.4.—Technical publication dealing with the application of various instruments in the treatment of water supplies.

Bakelite, Ltd., 12-18, Grosvenor Gardens, London, S.W.1.—20-page illustrated catalogue of mouldings in Bakelite materials.

Hendrey Relays, Ltd., 392, Bath Road, Slough, Bucks. — Loose-leaf catalogue illustrating a range of the company's relays and associated apparatus.

Siemens Electric Lamps & Supplies, Ltd., 38-39, Upper Thames Street, London, E.C.4.—Two illustrated leaflets: floodlighting fittings for buildings, parks, goods yards, etc. (8/53), and shop lighting fittings (9/53).

Wm. Sanders & Co. (Wednesbury), Ltd., Falcon Electrical Works, Wednesbury.—Four illustrated catalogues and leaflets illustrating consumers' control units, a range of fuse switches, "Sandasteel" fuse boards and rubber unbreakable plugs.

Edison Swan Electric Co., Ltd., 155, Charing Cross Road, London, W.C.2.— Illustrated leaflet describing new metal-clad switch units with protected dollies (CE.1730).

London Electric Wire Co. and Smiths, Ltd., 24, Queen Anne's Gate, Westminster, London, S.W.1.—Two booklets dealing with "Lewmex" synthetic enamelled wires and synthetic enamelled rectangular conductors.

Mond Nickel Co., Ltd., Sunderland House, Curzon Street, London, W.1.— 32-page booklet on spheroidal graphite cast iron dealing with its engineering properties and applications.

Falk, Stadelmann & Co., Ltd., 91, Farringdon Road, London, E.C.1.—Illustrated priced catalogue of the company's range of illuminating glassware (799-53).

Revo Electric Co., Ltd., Tipton, Staffs.—Catalogue binder, designed to incorporate all the "Revo" standard publications including those on lighting equipment, switch- and fuse-gear, fans, domestic appliances, street lighting equipment, etc.

Information Department

THE extensive records of our Information Department enable us to reply to most queries, but occasionally we ask our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the makers of the following:—

"Stanton" wall brackets with candle type shades.

General inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by the Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

NEW ELECTRICAL EQUIPMENT

Plant Irradiation Fitting

As a result of development work in co-operation with the John Innes Institution and the Electrical Research Association, Benjamin Electric, Ltd., Brantwood Road, London, N.17, has brought out a plant irradiation fitting for promoting the growth of tomatoes, cucumbers, etc. The reflector is of heavy gauge "Crysteel" vitreous enamelled white inside and grey outside to withstand arduous conditions. The g.e.s. porcelain holder for the 400 W mercury discharge lamp is fitted with an X type flange, while the open canopy and twin suspension plate are of heavy gauge steel with a corrosion-resistant finish. The price of these fittings is 65s each.

Double-Pole Cooker Switch

A cooker switch meeting the requirements of both home and overseas markets is now being made by Tok Electrical & Industrial Mechanisms, Ltd., 264/270, St. John Street, London, E.C.1. It is for either single- or double-pole operation, the transition requiring only the removal of one terminal thereby easing the manufacturers' problems associated with dual-purpose apparatus. Several different sequences are possible by rearranging the contacts. Operation of the silver contacts is by a cam on the centre spindle which is indexed by flat springs. The whole is built on a ceramic base and enclosed by a Bakelite cover. Although the rating is 15 A 250 V a.c., the switch is only 1 1/16 in by 1 3/8 in by 2 3/8 in beneath panel (including terminals).

Table Lamp Adaptor

A four-pronged metal fitting suitable for converting a bottle or narrow necked vase into a table lamp has been placed on the market by S. I. Engel, 23, Kensington Park Road, London, W.1. When placed inside the neck of a bottle the four sprung legs immediately distend and grip tightly, thus providing a firm base on which to screw a threaded lampholder. This "Universal" adaptor costs 1s 6d.

Air-Break Motor Starters

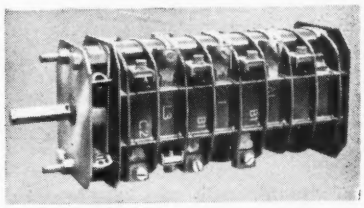
A new range of contactor-type air-break motor starters in attractively designed pressed steel casings has recently been introduced by J. A. Crabtree & Co., Ltd., Lincoln Works, Walsall, Staffs. The range includes models for controlling motors with ratings from ½ h.p. to 17½ h.p. and comprises direct-on, two-speed, three-speed, reversing and star-delta starters. All components are standardized and interchangeable between models, while the terminal connections are clearly marked to correspond with the standard motor terminal designations. Overload releases, auxiliary contacts, isolators and padlocking devices can be fitted if required. The cases of these B15 starters have 16 knockout conduit entries and both flush and surface mounting patterns are available.

Multi-Pole Rotary Switch

A new design of multi-pole roller contact rotary switch, known as Type 303, is now being made by Brookhirst Switchgear, Ltd., Northgate Works, Chester. There are two sizes with ratings of 30 A and 60 A respectively at 550 V a.c. and d.c. The making and breaking capacities are much larger than the nominal ratings and very high for the sizes of switch. Arrangements from two to five cells are standard and available from stock.

Primarily this switch is intended for use as an "on-load" main current switch on individually driven machine tools and is particularly useful for forward and reverse motor control and for control of two-, three- or four-speed change-pole motors.

The switch is of robust yet compact construction and is normally supplied for back of panel mounting. The "dumb-bell" shaped moving contact rollers (when in the "on" position) bridge across a pair of fixed contact strips thus providing a double break. Due to the rolling action of the moving contacts any wear is evenly distributed the contact faces are kept clean and their life prolonged. The switch has four positions controlled by a cam-operated, spring-loaded mechanism.

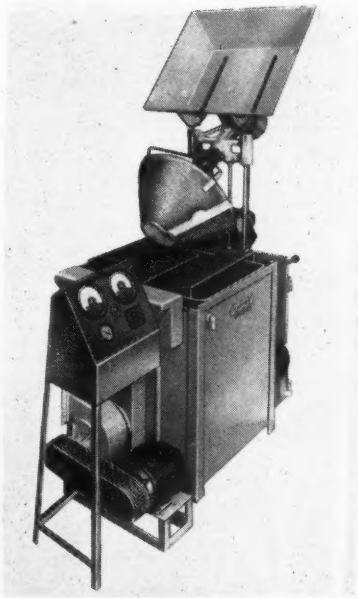


Brookhirst multi-pole rotary switch

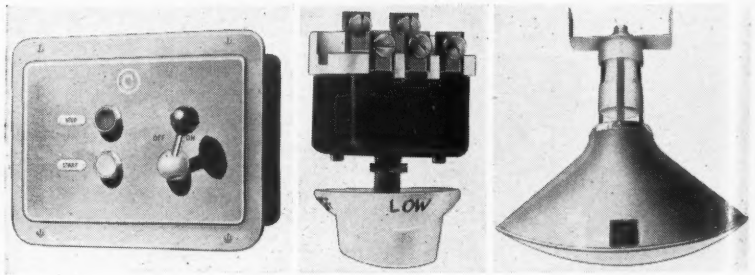
Chrome Plating Barrel

The "Victor" chrome plating barrel manufactured by W. Canning & Co., Ltd., Great Hampton Street, Birmingham, 18, is a compact machine designed to handle bulk quantities of small components. The barrel lifting and lowering gear is operated by a hydraulic system, the power for which is supplied by a motor-driven oil pump. Other features include a self-emptying conical barrel, water jacketed lined tank, exhaust fan and fume exhaust duct, emptying tray and control panel.

The equipment has a capacity of ½ to ¾ pint of articles and measures 6ft 9in in length by 2ft 9in in width. The height, with hood raised, is 7ft. A larger capacity barrel is in course of construction.



"Victor" chrome plating barrel



Left: Crabtree B15 flush mounting motor starter with isolator. Centre: Tok double-pole 15 A a.c. cooker switch. Right: Benjamin Electric fitting for the irradiation of plants

Responsibility for Rural Electrification

IN HIS REPORT to the Blackawton Parish Council at its December meeting, Councillor C. J. Barnett, chairman of the Electricity Committee, pointed out that the provision of electricity to the rural areas was now so costly as to make it a virtually impossible proposition to the many farms and dwellings still without a supply. He said that in the opinion of his committee this position was entirely due to the fact that the electricity authorities had misconstrued the wording of the Act to mean that each Area Board should deal with the finance of its rural electrification separately from the resources of the Authority as a whole. In response to a manifesto in April last, Lord Citrine said, in effect, that the duty of rural electrification was laid upon the Electricity Boards. That this statement was in error, however, was made clear by the official summary of the Act wherein it was stated that the Act required the Central Authority as well as the Area Boards, in the exercise and performance of their functions, to extend supplies to rural areas and to cheapen supplies.

The chairman of the Parish Council (Councillor F. L. Mitchell) said that the Electricity Committee had thrown a new light upon this very difficult problem. Apparently the authorities did not understand their own Act, and the Consultative Council should be made aware of this disclosure without delay so that they could work for the country districts which were now the modern depressed areas and from which the population was so rapidly drifting.

A resolution that a copy of the minute should be sent to the Minister of Fuel and Power and other interested bodies was carried unanimously.

Power Station Extensions

The British Electricity Authority has received the consent of the Minister of Fuel and Power to the extension of the Lincoln and Mexborough power stations. Two 20,000 kW turbo-generator sets and four 120,000 lb/hr boilers will be installed at Lincoln, bringing the installed capacity of the station up to 86,000 kW. At Mexborough the new installation will consist of two 30,000 kW turbo-generator sets and three 180,000 lb/hr boilers, increasing that station's installed capacity to 120,000 kW.

Scottish Power Station Site

It is reported that a large generating station may be built by the British Electricity Authority at Kincardine-on-Forth; a capacity of 720 MW has been mentioned. Referring to the project recently Mr. M. E. Taylor, planning officer, Fife, said that the power station would bring many amenities. He believed that between 200 and 300 new houses would be needed for the workers. One of the reasons for choosing the Kincardine site was its proximity to the Forth. He said that the County Council had tried to get the power station built at Methil, but the B.E.A. had turned that down. The project was a national one and the Planning Committee had had an opportunity of discussing it in general terms.

South Wales Power Station

Barry Town Council has passed a resolution favouring the erection of a power station within the borough. Failing this, it would like to see the station established as near as possible to the borough boundary, or if this cannot be done it would favour the erection of the station at the Leys, feeling that the existence of the station there would provide employment for many Barry residents. Only one member of the Council voted against the resolution.

Electricity Boards' Sales

The monthly statement of electricity output issued by the Ministry of Fuel and Power was published in our issue of 25th December (p. 1445). The table below analyses the sales of the Area Boards for the month. The national figures show an increase over November, 1952, of 2·3 per cent, but when corrected for weather and the number of effective working days the increase is 8 per cent. The weather conditions were much warmer and there were more effective working days than in November, 1952.

Owen Falls Turbine Starts

Last week the first of the 15 MW turbines at the Owen Falls hydro-electric scheme began turning under a 45ft head. The scheme provides for an ultimate installation of ten of these sets but the first stage comprises six. The turbines are by Boving & Co. and the alternators by the British Thomson-Houston Co. Her Majesty the Queen is to inaugurate the plant on 29th April.

Progress in the North West

In his annual message to the North Western Electricity Board's 13,000 employees, Sir Joseph Hallsworth, the chairman, said they could look back on Coronation year " with satisfaction and not a little pride." Electricity sales had risen, the Board had been able to step up its programme for rural electrification, and service had been improved in many other ways. Sir Joseph said the Board's employees had responded well to his challenge to each

ELECTRICITY SENT OUT BY AREA BOARDS FOR THEIR CONSUMERS

Area Board	Totals for November (Million kWh)			Twelve Months Ended 30th Nov. (Million kWh)		
	1952	1953	Inc. or Dec. %	1952	1953	Inc. or Dec. %
London	599·2	543·2	− 2·9	5,347·6	5,664·7	+ 5·9
South Eastern	313·1	305·8	− 2·3	3,088·0	3,332·6	+ 7·9
Southern	363·0	362·8	− 0·1	3,588·1	3,910·4	+ 9·0
South Western	171·4	177·0	+ 3·3	1,732·4	1,893·8	+ 9·3
Eastern	507·4	502·4	− 1·0	5,010·0	5,414·5	+ 8·1
East Midlands*	422·6	420·9	− 0·4	4,292·6	4,619·0	+ 7·6
Midlands*	568·1	582·0	+ 2·4	5,864·3	6,141·2	+ 4·7
South Wales*	287·0	318·4	+ 10·9	3,245·4	3,444·8	+ 6·1
Merseyside and North Wales*	306·5	317·2	+ 3·5	3,357·9	3,441·6	+ 2·5
Yorkshire*	543·1	558·7	+ 2·8	5,682·6	6,009·8	+ 5·8
North Eastern*	320·4	336·1	+ 4·9	3,487·3	3,620·0	+ 3·8
North Western*	592·1	626·9	+ 5·9	6,308·1	6,708·9	+ 6·4
South-East Scotland	117·7	123·0	+ 4·5	1,219·1	1,287·8	+ 5·6
South-West Scotland*	293·2	297·7	+ 1·5	2,936·9	3,103·3	+ 5·7
Total all Area Boards	5,364·8	5,472·1	+ 2·0	55,160·3	58,592·4	+ 6·2
Direct Supplies by Central Authority	64·7	83·2	+ 28·6	726·8	939·8	+ 29·3
Grand Total	5,429·5	5,555·3	+ 2·3	55,887·1	59,532·2	+ 6·5
Mainly Industrial Areas*	3,333·0	3,457·9	+ 3·7	35,175·1	37,088·6	+ 5·4
MainlyNon-Industrial Areas	2,031·8	2,014·2	− 0·9	19,985·2	21,503·8	+ 7·6
Number of Effective Working Days	27·12	27·36				

* Those in which industrial consumers took over 50 per cent of the total sales in the preceding financial year.

of them, made last March, to help to keep down electricity prices to the consumer by increased efficiency " all along the line."

Small Irish Stations

The initial steps have been taken by the Irish Electricity Supply Board for the erection of a small peat powered generating station in Co. Kerry. Three other stations are planned, one each in Clare, Galway and Donegal. The Kerry station will be at Cahirciveen, where the Board has given notice of intention to make an order for the compulsory acquisition of slightly over three acres of land.

Electricity for Gas-Lit Estate

The Brentford and Chiswick Housing Committee has accepted an offer by the Southern Electricity Board to provide an electricity supply to 146 gas-lit houses at Ealing Road, Brentford, at a reduced charge of £1,182 on the understanding that the Council will install additional points for an immersion heater and cooker.

Flamborough Head Cable

Instead of erecting an 11 kV overhead line at Flamborough Head the Yorkshire Electricity Board has now decided to lay an underground cable and build a small substation in order to preserve the natural amenities of the district. This was announced at a meeting of the Bridlington R.D.C., which had objected to the original proposal.

Supply Rearrangement

Radio communication was used by engineers of the Merseyside and North Wales Electricity Board to speed up the changing over of the supply to the Moreton area of Wallasey from one 11 kV cable (from Wallasey) to another (from Hoylake). A radio van was stationed at the Poulton generating station, Wallasey, and another at the substation near Moreton Cross. The interruption of the supply to consumers lasted only a few minutes.

Disagreement on Estate Supply

Last week the Southern Electricity Board issued a statement regarding the terms of supply to a housing estate at Farnham Common (Bucks). It said that the North Thames Gas Consultative Council had protested to the Minister of Fuel and Power that the Board's demand amounts to a denial of freedom of choice between gas and electricity. It had been stated by the managing director of the building company concerned that the Board had required a capital contribution of £19,080 and a guaranteed revenue of £19,040 for five years. Actually, said the Board, it had only required the company to provide two substation sites, lay ducts for cables and guarantee a gross annual revenue of £1,608 12s for five years. No capital contribution towards mains and distributors had been asked for. The scheme would involve the Board in capital expenditure of about £11,000 and it would be uneconomic unless the guaranteed return was exceeded. In conclusion the Board said that the last communication from the company had been an acceptance of its quotation.

The managing director of the company said that he had approached the Gas Consultative Council only when a time limit he had fixed for a new quotation had been reached. He was prepared to guarantee a revenue of from £800 to £1,000 a year, but not £1,608.

Sir Joseph Hallsworth, chairman of the North Western Electricity Board, and the Lord Mayor of Manchester, Alderman A. Moss, look on as Mrs. Greenhalgh tries out the new electric kettle presented to her by the Board at a ceremony to mark the connection of the 200,000th new consumer since vesting day (Electrical Review, *25th December, p.1425*)

Installations in Pre-War Houses

Sunderland Town Council has received sanction to borrow £7,645 for the installation of electricity in 263 pre-war council houses.

This year the Newcastle-on-Tyne City Council will reach the third year of its five years' programme for installing electricity in old council houses which have hitherto been served only with gas. About 900 houses on estates in the city's west end are expected to be connected during the year.

Radio-Equipped Ambulances

Northumberland County Health Committee is to spend £6,800 in installing radio apparatus in 39 ambulances. This step, it is believed, will improve efficiency and the saving in running costs is expected to more than offset the initial capital cost. Maintenance will cost £1,100 annually.

South Tyne Rural Supplies

The North Eastern Electricity Board has outlined to Haltwhistle Rural Council its plans for supplying electricity to the South Tyne rural area. The Board will extend its high-voltage lines to most farms, provide substations and install l.v. lines to farms, farm buildings and cottages. The Board will bear the first £400 of the cost of each development scheme. Where farms are situated close to high-voltage lines they will receive a supply almost free of charge; those 100 yd away will pay £66, 200 yd away £107 and 300 yd away £147. Where farmers are unable to pay a lump sum to cover their contribution, the Board will arrange a rental system under which there will be an annual charge of 7½ per cent on all capital expenditure over £400.

Cooker Installation Costs

Stanley (Co. Durham) U.D.C. is taking up with the North Eastern Electricity Board the charges imposed for installing cookers in houses. The Council contends that it could carry out the work itself at a lower cost.

Large Quebec Scheme

The Quebec Hydro-Electric Commission has decided to harness immediately 1,200,000 h.p. from its huge Bersimis River project. Earlier plans were to harness 300,000 h.p. initially and later extend production. Announcing this, Premier Duplessis said that the project was now considered much bigger than thought at first.

Western Australian Extensions

The Western Australian Government has approved the addition of a third generating unit, of 30,000 kW capacity, together with two boilers, at the Bunbury power station.

Supply to Sewage Works

Although its consulting engineers considered that the terms were excessive, Felling (Co. Durham) U.D.C. has agreed to pay the North Eastern Electricity Board nearly £3,000 towards the cost of supplying electricity to the Council's new sewage works.

Electrical Manufacturing–1953

Activities of C. A. Parsons & Co., Ltd.

DURING the past twelve months C. A. Parsons & Co., Ltd., have received a large number of orders for generating plant, including a second 100 MW set for a power station in this country and 30 and 60 MW sets for stations both in this country and abroad. In addition, an order has been received for a 15 MW pass-out turbo-generator for a paper mill in the Thames district and another for a turbo-blower to deliver free air at 32,430 cu ft/min and 35 lb/sq in pressure for a steelworks in India. The latter machine will be a duplicate of the turbo-blower installed in the same power house in 1947.

Among the 30 MW sets for this country are the fifth and sixth turbo-generators for Connah's Quay generating station, and the fourth and fifth machines for the new East Yelland station. The 60 MW sets include a third turbo-generator for the new Tilbury power station, a second machine for Dalmarnock and two 60 MW units for Machen. The 100 MW set is the second machine ordered for Ferrybridge and the two will operate with steam at 1,500 lb/sq in and 975 deg F with reheat to 950 deg F between the h.p. and i.p. cylinders.

For overseas, there is a third 30 MW set for Bulawayo, Southern Rhodesia, and three 60 MW sets for Lake Macquarie power station, Australia, bringing the total number of machines supplied or on order for the latter station to six.

Turbo-generators completed or put into commercial operation during the year totalled over 1,000 MW, over half of which were installed in this country, while the remainder were installed in Canada, Australia, South Africa, Southern Rhodesia, Malaya and India. The output of machines dispatched from Heaton Works and put into commercial operation over the last three years now totals 3,142 MW.

Among the large machines completed was the fourth 100 MW set at the Richard L. Hearn generating station, Canada, and 60 MW sets at Keadby, Littlebrook "C" and North Tees "C"; a 52·5 MW set at Nechells, Birmingham, and 50 MW sets at Braehead, Glasgow, and Bunnerong, Australia. Other turbo-generators ranging in size from 3 MW up to 30 MW have been completed in this country and overseas, some of the smaller sets being installed in industrial power stations and arranged for steam extraction for process purposes. A number of turbo-blowers have also been put into commission.

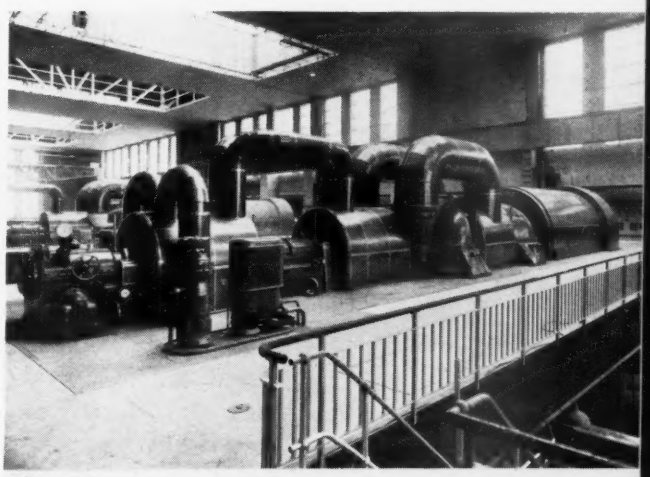
The company's new transformer shop is now in full operation, so there has been a noticeable increase in production in this direction. A number of orders for large power transformers with outputs ranging from 10 MVA to 120 MVA for service voltages up to 132 kV have been received. The majority of these units are for direct connection to the company's turbo-alternators and include a second 120 MVA unit for Ferrybridge power station, two 72 MVA units for the stations at Stella and two further 36 MVA transformers for each of the stations at Connah's Quay and East Yelland.

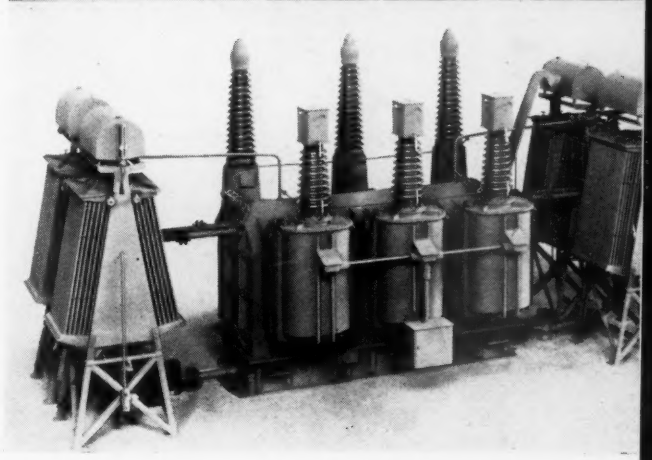
Extensions to existing stations abroad have resulted in orders being received for two 18 MVA and two 10 MVA transformers for Malaya, each unit being equipped with on-load tap changing equipment. Orders for transformers for use in this country include two 15 MVA 66 kV units, four 15 MVA and eight 7·5 MVA 33 kV units.

The increasing use of electricity abroad is reflected in a number of orders which have been received for small power and distribution transformers for export. One of these orders was for 43 units, having a total of over 40 MVA, for a new oil refinery. A number of transformers of various sizes are also being made for India, Malaya, Rhodesia and Venezuela.

During the past year a number of 132 kV generator and transmission transformers were dispatched and put into commission. Three of the largest transformers ever built by Parsons have also been dispatched. These were single-phase units forming a three-phase 11–22/275 kV bank, having an equivalent output of more than 200 MVA. The total weight of the bank as installed at the Reyrolle Switchgear Testing Station, Hebburn, Co. Durham, is about 500 tons.

Early in the year the meridian circle was installed at San Fernando Observatory, near Cadiz. In the summer





Parsons turbo-generators completed last year totalled over 1,000 MW; a 60 MW set at Keadby is illustrated. The bottom picture shows a model of a 120 MVA 275 kV transformer

the Copenhagen meridian circle was installed and the reports on both these instruments have been satisfactory. At Oxford the 20in solar telescope was installed and in the autumn the Cambridge Schmidt telescope was installed, but this instrument has not yet been set to work. The 10in photographic zenith tube for Neuchatel Observatory was completed in the works during the summer.

Work has been proceeding on the 98in Isaac Newton mirror which has now reached the final figuring stage. An order has been received for 60in Schlieren test equipment to be installed at the National Aeronautical Establishment, Bedford.

Among the infra-red instruments, 19 spectrometers and double-beam units have been completed during the year, including three instruments for Holland and one for New Zealand. New spectrometer developments are under way, but present production will not be affected for several years.

The 18 infra-red gas analysers produced during the year included two for the United States, one for Canada, one for Australia, one for India and one for France. The Australian instrument is for use in the Anglo-Iranian oil refinery in Western Australia. A much-simplified instrument shown at the Physical Society Exhibition has since been further developed and, it is hoped, will soon be ready for production.

TRANSISTORS OR VALVES?

IN opening a discussion on "Will Transistors Oust Receiving Valves?" at the Institution of Electrical Engineers, Radio Section, recently Mr. E. H. Cooke-Yarborough, M.A., said it was first necessary to consider how well a junction transistor could perform the functions which were the principal duties of the radio receiver valve, namely, to amplify linearly (and perhaps rectify) at audio, intermediate and radio frequencies. Following Giacoletto's analogy* between a junction transistor and a pentode, the emitter, base and collector could be taken as being equivalent to the cathode, grid and anode. Then a typical junction transistor would be inferior to the pentode in the following respects: some percentage of the cathode current flowed to the grid, so the grid-to-cathode impedance was only 10–50 times $1/g_m$ and might be very variable; there was a resistance of about 1 megohm between the anode and grid, shunted by a capacitance of several μF; transit-time effects became appreciable at frequencies of about 100 kc/s; noise factor varied from unit to unit and with frequency over the range 3–30 db; power dissipation was limited to a few tens of mW, though 2 W units had been made experimentally. On the other hand it would be superior in the following respects: small physical size; no heater or screen supplies were needed; it was capable of operating with a supply voltage of about 1 V and current less than 1 mA; use of either n-p-n or p-n-p units allowed operation with voltage and current of either polarity; mutual conductance varied with cathode current, but was about 50 mA/V.

Certain of the disadvantages could be minimized by suitable circuit design, and in particular the equivalent of earthed-grid operation became more attractive. In small portable electronic devices, such as hearing aids and monitors of nuclear radiation, the advantages of transistors might be decisive, and a big expansion in the use of transistors for such purposes could be looked for. Point transistors differed from junction triodes mainly in two respects. First, the upper frequency limit was higher (about 1–10 Mc/s); secondly, the current gain exceeded unity, so (using the pentode analogy) that the current flowing between the anode and grid was about twice that flowing between the grid and the cathode. Point transistors had been used in this way at frequencies above the limit for junction triodes, but were likely now to be ousted by junction tetrodes.

The effect of current gain exceeding unity was analogous to grid emission in a valve, which could cause the valve to lock itself in a strongly conducting state. The same could happen with a point transistor, but at currents which were not injurious. Thus a single point transistor could be made into a bi-stable circuit.

The cost and availability of the transistor were considered by several speakers. The retail price of a junction-type and of many point-contact type transistors was somewhat less than twice that of comparable thermionic valves, and it was probable that within two to three years transistors would be produced in sufficiently large quantities to enable them to be built into standard model radio and television receivers. At present the power dissipated had to be kept below 1–2 W and this was regarded as a serious drawback; the great merit of the extremely small size of the transistor would moreover be lost if space had to be provided around it when there was danger of its running hot. It was, however, pointed out that transistors dissipating as much as 20 W were being produced in the United States. The enhanced flexibility in circuit technique afforded by the transistor through the reversible functions of its collector and emitter was an additional advantage over the valve.

An important question posed early in the discussion was whether there existed any fundamental obstacle in the way of transistor development which might prevent its ultimately replacing the receiving valve. This was held not to be the case, the greatest difficulty confronting the transistor designer and user being the narrow tolerances in operating frequency, which resolved essentially into a problem of precision engineering. The operating frequency of the transistor depended upon the emitter-collector spacing as it did in the valve upon the grid-cathode spacing. In order to function up to 1,000 Mc/s as an oscillator, a thermionic valve required a grid-cathode spacing of 4×10^{-3}in, while for comparable results the transistor needed an emitter-collector spacing of the order of 5×10^{-4}in. This arose from the fact that the electrons in the valve moved at far higher velocities *in vacuo* than did the electrons and holes in the semi-conducting material of the transistor. Strong hopes were expressed that these constructional difficulties would be overcome; an experimental transistor had in fact already been made to operate at 80 Mc/s, and in the United States transistors were available with 5×10^{-4}in spacings operating at above 50 kc/s.

The transistor was further criticized on account of its inability to operate under high ambient temperature conditions which excluded it from many applications in military and in air-force equipment in particular. No means of overcoming this difficulty, inherent with germanium, was at present known, so that the quest for alternative semi-conductor materials would have to be continued. It was suggested that the most promising future for transistors lay in their use in equipment where their low bulk and weight would be of advantage.

* Giacoletto, L. J., Proceedings of the Institute of Radio Engineers, 1952, 40, p. 1490.

Engineering in Europe

Abstracts from Foreign Technical Journals

THE great importance of a combined generation of electric power and saleable heat resides in the fact that it offers prospects of an almost 100 per cent utilization of the thermal energy available. The not inconsiderable initial costs of the thermal power station and the thermal distribution system are partly offset by the saving on condensing plant, but not in the sense that the latter can be fully dispensed with, since normally the demand for heat will be very small in summer (only industrial consumers remaining), condensers then being required for covering the electric peak loads.

The author bases his considerations on a medium-size town of a population of 350–400,000, and on probable consumption figures in about 10 years' time. These are about 200 MW, 900 million kWh and a thermal peak load of 400 million kg cal/hr. For such figures the supply of most of the electrical and thermal energy demand from a combined power and district (or town) heating station would be an economic proposition, at least during the winter season. It is also shown that the hot-water distribution system is preferable to steam distribution, although the operating costs of a system working with steam are lower. The final comparative figures of combined stations, thermal power stations and (as regards primary costs) hydro-electric power stations are definitely comparable, which proves the advantages of the combined system.—" District Heating as a Problem of Electrical Economics," F. Marguerre, *Elektrizitätswirtsch.*, Vol. 52, No. 19, pp. 561–565, 1953, in German.

Transmission Lines

The inequality of the span lengths of a transmission line, caused by unequal spacing of the supports necessitated by the nature of the region crossed raises, in the case of considerable differences in the lengths of adjacent spans, doubts about the possibility of using slip or releasing clamps. On the other hand, the use of dead-end clamps necessitates intermediate supporting structures of a far heavier construction. A comprehensive analysis of the problem carried out by the author showed that the deflection angles of the insulator strings, which indicate the differences in the conductor tensions of adjacent spans, are not at a maximum where the differences in the span lengths are greatest, but actually depend only, or mainly, on the differences between temperatures at erection and at a given instant after erection.

The safest way of avoiding dangerous deflections is to carry out erection work at temperatures round about freezing point. Apart from this, the absolute values of the string deflection angles are so small that there does not seem to be any cogent reason to use dead-end clamps, at any rate not in any of the many cases selected and calculated by the author, the results of which are presented in a tabulated form.—" Unequal Span Lengths in Transmission Lines where Releasing Clamps are used," G. M. Rozanov, *Elektrichestvo*, No. 9, pp. 11–15, 1953, in Russian.

Overhead Line Span Lengths

An account is given of the advantages of the method of calculating steel-aluminium conductors from the real characteristics of the materials, these advantages being mainly in the economic field. On the other hand, they also permit of increasing the theoretical span lengths, if the height of the supporting structures remains unchanged. The percentage increases of the span lengths are, for certain conductor materials, between 14 and 18 per cent, for others about 11 per cent, the achievable lengthening also depending on the climatic conditions of the region.

For 110 kV lines on wooden poles, with releasing clamps, the spans may be increased from 205 to 235 m, corresponding to an average wood saving of 6 per cent per pole and 13 per cent saving on insulators and fittings, to which has to be added the saving in erection work due to the reduced number of poles. Certain fears about the vibration phenomena in composite conductors could be dispelled by comprehensive investigations yielding the result that all these phenomena are perfectly controlled and rendered harmless by the usual type of vibration damper, so that no undue wear will occur.—" Increase of the Theoretical Span Lengths of Overhead Lines," M. M. Belousov, *Elektrichestvo*, No. 9, pp. 9–11, 1953, in Russian.

Switching Surge Attenuation

The theoretical investigation of switching surges is comparatively easy, if correct equivalent circuits are chosen by which the interesting cases may be represented; viz., circuit breaking either with a considerable inductance between generator and breaker, with a parallel capacitance across the breaker (corresponding to a short-circuit), or with series inductances and parallel capacitances at either side of the breaker or, lastly, with inductance and parallel capacitance before, and a capacitive circuit behind, the breaker. The last two cases correspond to disconnecting an idling transformer, and to cutting-out capacitor banks or idling lines, respectively. These cases are really the most dangerous ones, because they involve instability of the arc in the breaker, rupture of the weak currents before the natural zero and re-ignitions of the arc.

These ruptures of the current through the breaker are so sudden as to give no time to the current in the inductance to vary appreciably, and the electro-magnetic energy stored in the inductances is then transformed into electrostatic energy and stored in the parallel capacitances. The discharge of the latter sets up oscillations in the LC circuit, the amplitudes of which may, in the worst case, become as high as the sum of the system voltage and a value corresponding to the dielectric strength of the non-ionized break of the breaker.

However, this is only a theory, because in reality the break is always more or less ionized, and the voltage amplitude may ultimately depend on the relative rates of de-ionization and rise of the recovery voltage, the latter depending on the parameters of the LC oscillation circuit. In the case of transformers, hysteresis losses and certain line parameters may mitigate the surge dangers. Experiments with oil and air-blast breakers and breakers with magnetic blow-out, as well as with fuse-switches showed that really dangerous surges occur only in oil and air-blast breakers, but that the surges may be reduced to permissible values by suitable designs of the breakers. The same applies to fuse-switches (series arrangement of fuse elements).—" The Attenuation of Switching Surges due to Circuit Breakers and Fuses," *Bull. Soc. Franc. Elect.*, 7th series, Vol. 3, No. 32, pp. 455–465, 1953, in French.

Financial Section

STOCKS and SHARES

IN contrast with the previous year, the great majority of Stock Exchange securities ended 1953 at quotations materially better than those ruling at the start. An average improvement of 6 per cent in Government stock prices laid the foundation for a more substantial advance in the industrial market. At the back of these movements was, of course, the evidence of a strengthening of the nation's financial position; the concessions and freedoms provided in the Budget and other measures; the rise in industrial production; and a tendency towards less dividend austerity in the company world. Industrial wage problems were responsible for some wavering of prices during the closing month, but the tone of markets at the finish was encouragingly firm.

Gilt-Edged Factors

Apart from moderate reactions in the middle and again at the end of the year, the value of gilt-edged securities pursued a steadily upward course. This was punctuated by a sharp step upwards at the time of Bank Rate reduction in September. Otherwise the way for the improvement was indicated by the periodical returns on the state of the sterling area's gold and dollar reserves, which showed an increase in every one of the first eleven months. As an outward and visible sign of most of the other factors which contribute, or otherwise, to the solvency of the nation, the figures serve in a general sense as the barometer of the gilt-edged market. A greater readiness on the part of investors to trust to the long-dated and the " undated " stocks, such as War Loan and Consols, which had a particularly severe handling in the crises of former years, testified to the increase in confidence.

Electricity Stocks

Both the 3 per cent British Electricity stocks are about five points to the good, as compared with the prices of twelve months ago; the issue dated 1968/73 finished the year at 89½, and the 1974/77 issue at 88½. As a matter of now almost historic interest, the former stock was issued at 100, under the Electricity Act, 1947, to the former holders of electricity supply company securities; and the latter at a price of 99½ in 1948, towards the end of the " Dalton " cheap money era. The improvement in the 3½ per cent stock 1976/79, now 94, is also five points, while the 4¼ per cent stock, 1974/79, is up from 100 to 103½. Current yields on the first two have fallen below 3½ per cent, and on the others to 3¾ and a fraction over 4 per cent respectively.

Industrial Market

In the industrial market, the rise in the value of leading ordinary shares, as measured by the popular indices, has been in the neighbourhood of 11 per cent. In some particularly favoured sections it has been a good deal more. Apart from the improvement in the economic background, prices have been assisted in the past few months by a succession of good company results.

Fortnight's Price Changes

Company or Board	Nom. Value	Middle price 28th Dec.	Two Weeks' Rise or Fall	Dividend Previous	Dividend Last	Yield %	1953 Highest	1953 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	89½		3	3	3 7 0	90	83 11/16
Brit. Elec. 1974/77	100	88½		3	3	3 7 9	89	82
Brit. Elec. 1976/79	100	94		3½	3½	3 14 6	94¾	88½
Brit. Elec. 1974/79	100	103½		4¼	4¼	4 2 3	104	99⅛
Overseas Electric Supply								
Calcutta Elec.	£1	20/-		6†	6†	6 0 0†	21/-	18/-
East African Power	20/-	22/-		7	7	6 7 3	25/-	20/9
Nigerian Elec.	£1	24/6		10	10	8 3 4	25/-	21/6
Palestine Elec. " A "	£1	15/6	−1/6	Nil	Nil	Nil	19/3	7/7
Perak Hydro-Elec.	£1	13/6	−1/-	Nil	6	8 17 9	17/10	13/6
Equipment and Manufacturing								
Aberdare Cables	5/-	8/-	−3d	20	25	7 16 3*	8/9	7/4
Aerialite	1/-	10/9	+1/-	88½	88½	8 4 6	10/9	8/1
Allen, W. H.	£1	50/-		15	15	6 0 0	51/-	42/10
Aron Elec. Ord.	£1	43/9	+1/3	15	20	9 2 9	47/6	36/3
Assoc. Elec. Ord.	£1	42/6		20	20	4 14 3*	45/7	36/4
Automatic Tel. & El.	£1	61/3	—	15	15	4 18 0	65/3	55/-
Babcock & Wilcox	£1	47/6	+6d	18	18	—	50/-	40/4
Baldwin, H. J.	2/-	4/-		20	20	10 0 0	4/1	3/-
Bakelite	10/-	23/-	−6d	—	12½	5 8 9	24/9	16/-
British Aluminium	£1	37/-		12	12	6 9 9	43/10	35/-
B.I. Callender's	£1	38/3	+3d	9	10	5 4 6	40/10	33/3
B.I. Callender's 6% Pref. ...	£1	25/6		6	6	4 14 0	26/3	23/-
British Thermostat	5/-	18/9		30	35	—	19/-	14/-
British Vac. Cleaner	5/-	11/3	−1/6	25	25	10 4 0	16/6	11/-
Brook Motors	10/-	32/6	−2/6	20	20*	6 3 0	37/-	27/10
Brush Ord.	5/-	4/3		10	4	—	5/4	2/11
A. F. Bulgin	1/-	3/3		30	30	9 4 6	3/5	2/6
Burco	5/-	11/9xb	—	35	35	7 9 0*	12/2	8/6
Chloride El. Storage	£1	49/-	+1/6	15	20	4 1 9*	44/10	32/3
Clarke Chapman	£1	67/-	+2/-	15	17½	5 4 6	69/3	57/6
Cole, E. K.	5/-	23/6	+2/-	25	25*	5 8 9	23/6	14/2
Cossor, A. C.	5/-	7/-		10	10	7 2 10	11/4	6/4
Crabtree	10/-	23/9	−3d	17½	17½	7 7 3	32/6	24/6
Crompton Parkinson Ord. ...	5/-	14/6		11¼	20	6 18 0	16/-	8/7
De La Rue	5/-	13/-	+2/-	35	Nil	Nil	14/6	6/3
Decca	5/-	37/9	+3/-	112½	150	3 19 6*	37/9	17/6
Desoutter	5/-	16/3		16	18	5 10 9	17/6	14/3
Dewhurst	2/-	6/3		19	19	6 6 8	6/9	5/-
Dictograph Tel.	2/-	5/6		20	20*	7 5 6	5/10	3/10
Dubilier Condenser	1/-	4/-		28	25*	6 5 0	4/4	2/10
E.M.I.	10/-	11/9	−9d	12	8	6 16 3	15/3	11/9
Electrical Components	5/-	11/-		20	20	9 1 10	11/3	9/3
Elec. Construction	£1	53/9		15	15	5 11 9	56/-	50/6
Enfield Cable Ord.	£1	17/-	−6d	7½	5	5 17 9	24/10	17/-
English Electric	£1	40/-	+9d	15	15	—	40/8	34/-
English Electric 3½% Pref. ...	£1	15/6	−3d	3½	3½	4 16 9	16/4	14/6
Ericsson Tel.	5/-	47/6	+2/-	22†	22†*	2 6 3†	46/-	36/-
Ever Ready	5/-	25/-	−6d	35	35	6 7 3	29/-	25/-
Falk Stadelmann	£1	38/3	−1/3	15	15	7 16 9	44/3	38/3
G.E.C. Ord.	£1	38/9	−1/3	22½	11¼*	5 16 3	46/-	36/3
G.E.C. 6½% Pref.	£1	27/-		6½	6½	4 16 3	27/7	24/9
General Cables	5/-	16/3		30	30	9 4 9	17/-	14/9
Greenwood & Batley	£1	40/9		15	17½	8 11 9	41/6	38/-
Hackbridge Cable	5/-	12/3		20	20	8 3 3	13/-	10/4
Hackbridge & Hewittic	5/-	17/6		20	20	5 14 3	18/3	16/1
Hall Tel. Acc.	10/-	11/-		10	10	9 1 9	12/7	8/6
Heatrae	2/-	4/-		12½	12½	6 5 0	4/3	3/3
Henley's	10/-	16/-	−3d	20	10½*	6 11 3	19/4	16/-
Holophane	5/-	13/9		20	20	7 5 6	13/9	11/1

* After capital bonus. † Free of income tax.

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.

Earnings of many companies have evidently recovered from the 1952 recession, and, relieved of inflationary pressures, a number of them have been in a position to be a little more liberal in the matter of dividends. Undoubtedly, too, the "take-over" bid has played a part in bringing share prices into closer relationship with the modern value of the assets underlying them. Electrical equipment shares have fully maintained their high place in the confidence of investors.

In the course of a generally satisfactory year for the leading electrical equipment shares, the outstanding movements once again were the rises in A. Reyrolle and C. A. Parsons shares. The extent of the improvement is, in effect, better than is shown in the following table, for both companies made "rights" issues of shares, during the period, on very favourable terms. The rise in Crompton Parkinsons matches the increase in the dividend. A.E.I. remained well in favour throughout. In the tables below prices marked (*a*) are adjusted for capital bonuses since distributed. No allowance is made for the value of "rights" issues.

in Electrical Investments

Company or Board	Nom. Value	Middle price 28th Dec.	Two Weeks' Rise or Fall	Dividend Previous	Dividend Last	Yield %	1953 Highest	1953 Lowest
Equipment and Manufacturing—continued.						£ s d		
Hoover	5/-	25/6	+6d	35	25	5 0 0	26/10	20/3
I.C.I.	£1	54/-	+3 9	13	13	4 16 3	54/-	41/6
Intl. Combustion	5/-	15/-		25	15°	5 3 6	15/6	12/1
Johnson & Phillips	£1	49/-	−6d	15	15	6 2 6	59/3	49/-
Lancashire Dynamo	£1	43/9	−2 6	12½	12½	5 14 3	47/-	41/-
Laurence, Scott	5/-	13/9		15	15	5 9 0	14/6	11/9
Lister, R. A.	£1	31/6		9	9	5 14 3	34/3	27/9
London Elec. Wire	£1	38/-xb	—	12½	15	3 19 0°	38/3	26/-
J. Lucas	£1	51/3	+6d	9½	10⅝	4 4 6	51/3	35/6
Marryat & Scott	2/-	5/3	−6d	22½	22½	7 14 0	6/3	5/1
Mather & Platt	£1	53/6		12½	15	5 12 3	53/10	41/3
Metal Industries	£1	39/6	+1 6	15	12°	6 1 6	47/9	37/9
Midland Elec. Mfg.	£1	63/9	+1 8	15	15	4 16 0	63/9	56/3
Morphy Richards	4/-	16/3	+3d	40	40	9 17 6	16/3	13/-
Murex	£1	52/6	+1/-	15	15	5 15 6	60/9	50/6
Newman Ind.	2/-	2/6		10	10	8 0 0	2/10	2/-
Oldham & Son	1/-	2/9	+3d	35	17½°	7 0 0	2/10	2/2
Parnall (Yate)	5/-	4/6	+3d	6	6	6 13 3	4/6	2/6
Parsons, C. A.	£1	38/3	+2/-	10°	12½	—	48/-	27/9
Plessey	5/-	36/6	+2/6	25	30	4 3 3	36/-	20/1
Pye Deferred	5/-	16/3xb	+6d	18	20	—	15/9	10/6
Revo	10/-	17/6	+9d	27½	27½	—	17/6	13/11
Reyrolle	£1	66/-	+3 9	10°	12½	—	79/-	51/-
Richardsons Westgarth	5/-	9/3		12	15	8 2 3	11/1	8/6
Scottish Cable	4/-	13/3	+3d	32	20°	6 0 9	13/3	11/1
Siemens Ord.	£1	35/-	−6d	10	10	5 16 0	37/-	31/6
S. Smith (England)	4/-	12/6	+1 6	12½	15	4 16 0	12/6	7/11
Southern Areas	£1	19/6	+6d	5	6	6 4 6	19/7	10/3
Strand Elec.	5/-	7/9		17½	17½	11 5 6	10/-	7/9
Sturtevant	5/-	29/-		17½†	18·1†°	—	29/9	20/10
Sun Elec.	£1	25/-		15	15	12 0 0	27/-	24/6
Switchgear & Cowans	5/-	13/6		22½	22½	8 6 9	16/9	13/3
Taylor, T.	5/-	12/3	+6d	20	25	—	12/3	9/6
T.C.C.	10/-	42/6		20	20°	—	42/6	31/5
T.C. & M.	£1	31/-	+1/-	10	8½°	5 9 9	31/-	25/6
Telephone Mfg.	5/-	7/9		10	10	6 9 0	9/4	7/1
Thorn Elec.	5/-	14/-	+1/-	12½	12½	4 15 0	14/-	7/10
Thornycroft	£1	32/6	+6d	15	15	9 4 6	54/-	29/9
Tube Investments	£1	62/-	−3/-	15°	15	4 18 0	71/9	54/-
Vactric	5/-	10/-	+1/3	Nil	Nil	Nil	10/3	3/6
Veritys	5/-	5/-	+6d	7½	10	10 0 0	5/4	4/1
Wallsall Conduits	4/-	45/6	+1/-	70	70°	6 3 0	47/6	43/9
Ward & Goldstone	5/-	44/6	+1/-	45	45°	5 1 0	46/-	29/9
Watford	2/-	4/9	−3d	25	25	—	5/6	4/10
Westinghouse Brake	£1	62/6		14	15	4 15 9	64/-	51/3
West, Allen	5/-	13/-	−3d	15	15	5 15 6	14/4	10/3
Wolf Electric	5/-	11/-		—	15	6 16 3	12/8	9/6
Trusts, Transport and Communications								
Anglo-Am. Tel.:								
A Ord.	100	83½	−2	—	6	7 3 9	91	77
Ord.	100	57½		—	3¾	6 10 5	57½	53
Anglo-Portuguese	£1	21/9		8	8	7 7 3	23/9	20/1
Brit. Elec. Traction:								
Def. Ord.	5/-	37/6		25	35	4 13 3	37/6	21/3
Cable & Wireless:								
Ord.	100	148	+2	8	8	5 10 3	146½	124
4% Loan	100	96½		4	4	4 3 0	97¾	93
Calcutta Trams	£1	19/9		6†	2½†	—	23/6	16/-
Cape Elec. Trams	£1	13/-	+2/-	5½	5½	8 9 3	13/-	9/-
Marconi Marine	£1	28/9		10	10	6 19 2	31/6	26/9
Oriental Tel. Ord.	£1	75/-	+2/6	16	16	—	75/-	59/-
Telephone Props.	£1	4½	−2/6	8	8	—	126/3	33/-
Telephone Rentals	5/-	9/6		10	10°	—	10/-	6/8

Share	End of Year 1952	End of Year 1953
A.E.I.	37/6(*a*)	42/6
Crabtree	31/3	23/9
Crompton Parkinson	8/9	14/6
Elec. Const.	50/-	53/9
English Elec.	39/3(*a*)	40/-
G.E.C.	42/6	38/9
Lanc. Dynamo	42/6	43/9
C. A. Parsons	27/6(*a*)	38/3
A. Reyrolle	51/3	66/-
Westinghouse Brake	50/9	62/6

Cables and Telephones

London Electric Wire, on the strength of the share bonus and dividend, have been particularly prominent in the wire and cable manufacturing sections. B.I.C.C. also showed to good advantage, and Siemens and T.C. & M. were supported on the new transatlantic telephone project.

Share	End of Year 1952	End of Year 1953
Automatic Tel.	58/9	61/3
B.I.C.C.	33/6	38/3
Dictograph	4/2(*a*)	5/6
Enfield Cables	22/-	17/-
Ericssons	41/6	47/6
Henley's	18/9	16/-
J. & P.	52/-	49/-
London Elec. Wire	25/9(*a*)	38/-
Siemens	34/6	35/-
T.C. & M.	26/-	31/-
Telephone Mfg.	8/-	7/9

Miscellaneous Markets

Decca shares, on which a four-for-one share bonus was distributed, have more than doubled in value over the

Stock or Share	End of Year 1952	End of Year 1953
B. & W.	47/-(*a*)	47/6
B.E.T.	21/3	37/6
Brush	5/-	4/3
Cable & Wireless	126½	148
Chloride Elec.	31/3(*a*)	49/-
Cole, E. K.	14/6(*a*)	23/6
Cossor, A. C.	9/3	7/-
De La Rue	9/-	13/-
Decca	17/9(*a*)	37/9
E.M.I.	13/3	11/9
Ever Ready	26/-	28/-
Hoover	23/3	25/6
Lucas	36/3	51/3
Murex	55/-	52/6
Plessey	21/3	36/6
Pye	10/4(*a*)	16/3
Tube Investments	60/3	62/-

year, and have been among the most persistently active securities in the industrial market. "Ekcos" have acted well in the same group, and elsewhere special mention is due to Chloride Electricals, Plesseys, Lucas, B.E.T., and Cable & Wireless.

Bonuses and Dividends

The company which successfully ploughs back the bulk of its profits into the extension of its business reaches eventually, of course, a position in which a large disproportion exists between the nominal capital and the amount of money actually employed, and also between the level of earnings and the rate of dividend. The point was well made recently in the annual reports of the S. Smith & Son and Plessey companies, both of which are taking steps to bring the position into better alignment. Electrical and engineering companies which in the year just closed have improved their capital structures, by way of bonus issues, include A.E.I., English Electric, Chloride Electrical, Aberdare Cables, Sturtevant, Babcock & Wilcox, Decca, London Electric Wire, Parsons, and Brook Motors. Increased dividends have been declared by some of these and, among others, by Lucas, B.I.C.C., British Thermostat, Cromptons, Pye, Scottish Cables and Aron.

Recent Events

Westinghouse Brake & Signal made one of the last contributions of the year to the list of prominent companies intending to make a moderate increase in the rate of dividend. The 16 per cent payment, for the year ended last September, is a point above the previous rate, and is payable on capital increased by the "rights" issue of shares last April and by a recent acquisition. Trading profits of the year show expansion, although a larger tax charge leaves the net figure a little lower than before. The newly marketed 5s shares of Contactor Switchgear were dealt in actively at around 12s 6d in the early stages. There is a prospective yield of 9 per cent on the shares, on the basis of the 22½ per cent dividend indicated in the prospectus. Electrical Apparatus 5s shares, another recent introduction, are quoted at about the same price.

REPORTS and DIVIDENDS

Crabtree Electrical Industries, Ltd.—The annual meeting was held on 17th December when Dr. H. Schofield, who presided, said that the recession in trade referred to at the last annual meeting continued throughout most of the trading year under review and in consequence competition became exceedingly severe. During the year the new range of air break motor controls had established itself and was being increasingly used by many different industries; they had now extended this range by the addition of a starter specially suitable for smaller motors. They had also introduced a new range of a.c. flush switches and further new productions were coming out in the immediate future. Trade was undoubtedly better than at this time last year, and since the end of the year under review they had experienced a greater demand for their products than in the corresponding period last year.

Radio Rentals, Ltd., in a preliminary statement, shows a group trading profit of £536,440 for 1952–53, as compared with £364,178 for the preceding year. After deducting taxation, the sum attributable to Radio Rentals is £125,362 (against £99,893). It is proposed to pay a final dividend of 30 per cent (against 25 per cent), making 40 per cent (35 per cent), on increased capital.

The Westinghouse Brake & Signal Co., Ltd., reports a trading profit of the holding company for the year ended 26th September last of £800,814, as compared with £794,173 for the preceding year, and a trading profit of subsidiaries of £469,318 (against £389,559). After deducting depreciation, etc., and £763,048 for taxation, net balance of the parent company is £249,605 (£256,603), to which is added income and provisions not required of £102,905 and £178,428 brought in, making £530,938 available. Of this £70,000 is allocated to capital reserve plant replacement, staff pension reserve receives £10,000 and £42,000 is written off interest in a subsidiary. It is proposed to pay a dividend of 16 per cent for the year (against 15 per cent) on increased capital and to carry forward £228,468 (against £178,428 brought in).

Waygood-Otis, Ltd., has declared an interim dividend of 40 per cent (against 30 per cent).

Murex, Ltd., is paying an interim dividend of 6 per cent (same) on increased capital.

The London Electric & General Trust, Ltd., has announced an interim dividend of 4 per cent (against 3 per cent).

New Companies

W. Darby (St. Albans), Ltd.—Registered 30th November. Capital £1,000. Retailers, wholesalers and manufacturers of and dealers in radio and television sets, gramophones, etc. Directors: J. Ganderton and L. J. Walker. Regd. office: 154, London Road, St. Albans, Herts.

F. C. Ward & Son (Electrical), Ltd.—Registered 9th December. Capital £1,000. Contractors, manufacturers and installers of electrical, heating, lighting, power, radio, refrigerating and ventilating systems and equipment, etc. Directors: F. C. Ward, J. F. Ward and G. Utton. Regd. office: 261, King Street, Hammersmith, W.6.

Speedwell Batteries (London), Ltd.—Registered 3rd December. Capital £3,000. Manufacturers and patentees of batteries for motor vehicles, or for any other purposes, etc. Directors: F. R. M. Hedges and Dorothy E. Hedges. Regd. office: 3a, Mardale Street, Shepherd's Bush, W.12.

Hoddesdon Electrical Co., Ltd.—Registered 3rd December. Capital £100. To acquire the business of electrical engineers and installation and maintenance contractors now carried on at Hoddesdon, Herts, as "Smith & Hunter of Hoddesdon (Electrical)." Directors: F. W. A. Hunter, E. C. Smith and G. W. Walmsley. Regd. office: 21, Crossfield Road, Hoddesdon, Herts.

Blanella, Ltd.—Registered 4th December. Manufacturers of electric blankets, overlays and pads, etc. Directors: N. E. North, A. G. Sunderland and Mary Pickard. Regd. office: 8, Princes Square, Harrogate, Yorks.

Increases of Capital

A. Reyrolle & Co., Ltd.—Increased by £1,000,000, in £1 ordinary shares, beyond the registered capital of £3,000,000.

Taylor Tunnicliff (Refractories), Ltd.—Increased by £110,000, in £1 ordinary shares, beyond the registered capital of £10,000. At 31st March, 1953, Taylor Tunnicliff (Electrical Industries), Ltd., held 5,499 shares and Taylor Tunnicliff & Co., Ltd., held one share, out of 5,500 shares issued.

Welwyn Electrical Laboratories, Ltd.—Increased by £120,000, in £1 ordinary shares, beyond the registered capital of £30,000. The 20,000 5 per cent non-cumulative redeemable preference, 6,000 "A" ordinary and 4,000 "B" ordinary shares in the original capital have been converted into £1 ordinary shares. At 11th September the Worcester Royal Porcelain Co., Ltd., held a majority of the issued shares.

McColl & Sheppard (Electrical), Ltd.—Increased by £5,000, in £1 ordinary shares, beyond the registered capital of £5,000.

Liquidations

Edward Wolf & Son, Ltd., electrical contractors.—Winding up voluntarily. Liquidator, Mr. N. W. Osborne, 11–12, Finsbury Square, London, E.C.2, appointed 7th December.

Electrical & Sound Services, Ltd.—Meetings of members and creditors on 25th January at the offices of A. Hawes Richards, Barclays Bank Chambers, 39, Fleet Street, Torquay, to receive an account of the winding-up by the joint liquidators, Messrs. P. W. Hort and A. Hawes Richards.

Bankruptcies

B. T. Smith, The Studio, Ramsgate, Louth, Lincs, electrical engineer and contractor.—Public examination 7th January at the Town Hall, Great Grimsby.

A. S. Bennett, lately carrying on business at South View, Webb's Avenue, Stannington, Yorks, electrical contractor, now employed as an electrical engineer.—First and final dividend of 2⅜d in the £, payable at the Official Receiver's Office, 55, Queen Street, Sheffield, 1.

L. F. Kent, 32, High Street, Broadstairs, Kent, radio and electrical engineer.—Last day for receiving proofs for dividend 9th January. Trustee, Mr. A. M. Lanfer, 1, The Parade, Canterbury, Official Receiver.

C. G. Clews, 226, Stafford Street, Walsall, Staffs, carrying on business under the style of Clews Electrical Co., electrical contractors, and as "Clews Wee Bus," coach proprietor.—Last day for receiving proofs for dividend 5th January. Trustee, Mr. R. F. Bendall, 126, Colmore Row, Birmingham, 3.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 10th February from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1947

30310. Gall, D. C.—Electric supply stabilizing equipment for use in testing or calibrating electrical apparatus. 14th December, 1948. (703832.)

1950

1395. Electropol, Ltd.—Electro-chemical treatment of metals and alloys. 18th April, 1951. (703838.)

5071. Western Electric Co., Inc.—Electric circuits utilizing semi-conductor amplifiers. 28th February, 1950. (703685.)

9890. General Electric Co., Ltd., and Dudley, M. D.—Electric-discharge devices, especially cathode-ray tubes, and operating circuits therefor. 11th April, 1951. (703616.)

11009. English Electric Co., Ltd.—Electronic timing apparatus. 4th May, 1951. (703686.)

12514. Telegraph Construction & Maintenance Co., Ltd.—High-voltage cable terminations. 30th April, 1951. (703906.)

13812. Dubilier, W.—Manufacture of electrical condensers. 1st June, 1951. (703618.)

23216. British Broadcasting Corporation.—Recording of television pictures upon kinematograph film. 21st December, 1951. (703915.)

24308. Spodig, H.—Magnetic separators. 5th October, 1950. (703692.)

26210. Udall, J. B.—Electric plug connectors. 29th October, 1951. (703626.)

26565. Siemens-Reiniger-Werke Akt.-Ges.—Betatrons. 31st October, 1950. (703627.)

28345. Metropolitan-Vickers Electrical Co., Ltd.—Sealing glands. 31st October, 1951. (703696.)

28645. Anderson, Boyes & Co., Ltd., and Anderson, A.—Protective systems for polyphase a.c. loads. 24th December, 1951. (703630.)

28658. Standard Telephones & Cables, Ltd.—Power supply systems using batteries. 23rd November, 1951. (703918.)

29619. British Thomson-Houston Co., Ltd.—Electrical control circuits. 4th December, 1950. (703758.)

29769. General Electric Co., Ltd., and Richards, S. W.—Electric distribution systems. 5th December, 1951. (703920.)

31187. National Research Development Corporation.—Electrical cable connectors. 21st December, 1951. (703851.)

31200. Dunlop Rubber Co., Ltd.—Method and apparatus for measuring thickness by ultrasonic waves. 21st November, 1951. (703699.)

1951

11[illegible]. Soc. d'Electricité Mors.—Remote control and indicating devices. 16th January, 1951. (703633.)

21[illegible]. Crabtree & Co., Ltd., J. A.—Thermal overload release devices for electric switches. 4th January, 1952. (703767.)

24[illegible]. Smith & Sons (England), Ltd., S., and Hurzehill Laboratories, Ltd.—Modulating or demodulating devices. 1st February, 1952. (703[illegible]8.)

32[illegible]. Siemens Bros. & Co., Ltd.—Electrical contact springs. 8th February, 1952. (703[illegible]5.)

76[illegible]. Telephone Manufacturing Co., Ltd.—Electric selecting device responsive to impulses. 14th March, 1952. (703931.)

93[illegible]. Dixon, J. G.—Electrical conduit termination in electrical equipment and fittings. 10th April, 1952. (703769.)

9752. Bristol Co.—Synchronous contactor. 26th April, 1951. (703772.)

9753. Bristol Co.—Method and apparatus for deriving a fixed phase alternating potential from an indeterminate phase alternating potential. 26th April, 1951. (703773.)

9937. Magnesium Elektron, Ltd.—Electric primary cells. 16th April, 1952. (703643.)

11234. Parsons, Ltd., C. H., and Handley, G. B.—Sockets of electric plug-and-socket couplings. 7th April, 1952. (703933.)

11770. Libbey-Owens-Ford Glass Co.—Electrically conducting transparent films. 21st May, 1951. (703778.)

12074. Metropolitan-Vickers Electrical Co., Ltd.—Control of internal-combustion electric power plant. 27th March, 1952. (703649.)

12795. General Electric Co., Ltd., and Leeds, R. E.—Manufacture of cathode-ray tube envelopes. 22nd May, 1952. (703936.)

12948. Siemens & Halske Akt.-Ges.—Circuit arrangement for impulse control in telephone installations. 31st May, 1951. (703716.)

13654. Standard Telephones & Cables, Ltd.—Electrical welding equipment. 8th June, 1951. (703653.)

14395. British Thomson-Houston Co., Ltd.—Magnetrons. 18th June, 1951. (703656.)

14905. General Electric Co., Ltd., and Brabham, H. B. S.—Electric video signal circuits. 17th June, 1952. (703940.)

15488. Standard Telephones & Cables, Ltd.—Voltage indicator tube, particularly tuning indicator tube. 29th June, 1951. (703660.)

16647. Heat-X-Changer Co., Inc.—Electric heater for fluids. 13th July, 1951. (703662.)

18344. Venner, Ltd.—Electricity distribution systems and load-shedding devices therefor. 31st October, 1952. (703663.)

19179. Adkins, R. G., Fuller, C. E., and Gadsdon, D. F.—Electrically driven vehicles. 10th July, 1952. (703942.)

19363. British Thomson-Houston Co., Ltd.—Brush-shifting means for electric motors. 16th August, 1951. (703869.)

19385. Postmaster General.—Submarine cables. 1st August, 1952. (703782.)

21928. Venner, Ltd.—Electric relay devices. 17th September, 1952. (703790.)

22821. Hazeltine Corporation.—Control system for pulse-echo target position-indicating equipment. 1st October, 1951. (703667.)

23058. Reyrolle & Co., Ltd., A.—Control of electrical power station apparatus. 3rd October, 1952. (703668.)

23578. British Thomson-Houston Co., Ltd. Clothes washing machines. 10th October, 1951. (703795.)

23618. Standard Coil Products Co., Inc.—Cascade circuits. 10th Oct., 1951. (703946.)

24558. Philips Electrical Industries, Ltd.—Crystal diodes and methods of manufacture thereof. 22nd October, 1951. (703879.)

24585. British Thomson-Houston Co., Ltd.—Fluid supply systems. 22nd October, 1951. (703880.)

25585. Philips Electrical Industries, Ltd.—Electric discharge tubes for operation at short or ultra-short wavelengths. 1st November, 1951. (703727.)

26669. Oakley, J. L. (Marti, B. G.).—Variable output voltage transformers. 14th November, 1951. (703730.)

27101. Ryall, L. E.—Voice switching in telephone transmission systems. 7th November, 1952. (703801.)

28304. Wallace & Tiernan Co., Inc.—Automatic electrical message keying mechanisms. 3rd December, 1951. (703804.)

1952

259. British Iron & Steel Research Association.—Overhead electric transmission lines. 2nd April, 1953. (703674.)

374. Siemens-Schuckertwerke Akt.-Ges.—Contact converters. 4th January, 1952. (703952.)

1218. Crabtree & Co., Ltd., J. A., and Wintle, T. D. G.—Locking means for the covers of boxes housing articles or apparatus such as electric switches and the like. 24th November, 1952. (703955.)

1394 5. Tannoy, Ltd.—Moving coil loudspeakers and other forms of transducer. 16th December, 1952. (703809 10.)

1798. Busch-Jaeger Ludenscheider Metallwerke Akt.-Ges.—Rotary electric switches. 22nd January, 1952. (703812.)

1890. British Thomson-Houston Co., Ltd.—Temperature responsive control circuits. 23rd January, 1952. (703813.) 2278.—Stabilizing circuits. 28th January, 1952. (703742.)

3386. Philips Electrical Industries, Ltd.—Wiring supports for use at high voltages. 8th February, 1952. (703958.)

5159. British Thomson-Houston Co., Ltd.—Separator coatings for magnetic sheet materials. 27th February, 1952. (703746.)

6514. Huber & Cie. Akt.-Ges., J.—Bimetal-operated electric switch. 13th March, 1952. (703963).

6833. Philips Electrical Industries, Ltd.—Radio transceivers. 17th March, 1952. (703894.)

9078. Philips Electrical Industries, Ltd.—Methods of manufacturing cathodes constituted by a plurality of individual elements and cathodes manufactured by such methods. 9th April, 1952. (703748.)

15382. Busch-Jaeger Ludenscheider Metallwerke Akt.-Ges.—Holders for electric fluorescent or like discharge lamps. 18th June, 1952. (703974.)

17577. Babcock & Wilcox, Ltd.—Tubulous vapour generating and superheating units. 11th July, 1952. (703899.)

18643. Philips Electrical Industries, Ltd. (Naamlooze Vennootschap Philips' Gloeilampenfabrieken).—Recording and or reproducing apparatus. 23rd July, 1952. (703976.)

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections must be entered by 16th January:—

JEYMER. No. 720,525, Class 9. Electric kettles, flat irons, coffee percolators, and parts included in Class 9 of all these goods; and electric elements included in Class 9.—J. Flack, 9, Jeymer Avenue, London, N.W.2.

EMPRESS (design). No. 722,674, Class 9. Television sets and radiograms.—Britamer, Ltd., 11, Southampton Row, London, W.C.1.

CYGNET. No. 723,352, Class 9. Wireless, telephonic, television and telegraphic instruments, sound recording and sound reproducing instruments and parts of all such goods included in Class 9.—Electronics (Westcliff-on-Sea), Ltd., 14, Wickford Road, Westcliff.

NEXT WEEK'S EVENTS

Organizers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 231, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged

Monday, 4th January

BIRMINGHAM.—James Watt Memorial Institute, Gt. Charles Street, 6 p.m. I.E.E. South Midland Centre. Discussion on "Technical Education of Non-National-Certificate Students," opened by J. Ashmore and D. I. Meyrick. (Joint meeting with Education Discussion Circle.)

BRISTOL.—Electricity House, Colston Avenue, 7 p.m. I.E.E. Western Utilization Group. "Heavy Current Equipment in Ships," by N. T. Evans, and "Aids to Navigation," by N. C. Bow.

CARDIFF.—At the South Wales Institute of Engineers, Park Place, 6 p.m. I.E.E. Western Supply Group. Student's paper, "Alternators," by W. G. H. Lee.

CHATHAM.—Sun Hotel, 7.30 p.m. Institution of Electrical Engineers, District meeting. "Education for the Electrical Industry," by H. E. Etherington and L. J. N. Kirkley.

ILFORD.—Angel Hotel, 8 p.m. A.S.E.E. North East London Branch. "Flameproof Equipment," by H. S. Allpress.

IPSWICH.—Crown and Anchor Hotel, 6.30 p.m. Institution of Electrical Engineers. District meeting. "Modern Developments in Atomic Energy," by Dr. T. E. Allibone.

LEEDS.—Great Northern Hotel, 7.30 p.m. A.S.E.E. Leeds Branch. "Lighting."

LIVERPOOL.—At the Royal Institution, Colquitt Street, 6.30 p.m. I.E.E. Mersey and N. Wales Centre. "Electronic Telephone Exchanges," by T. H. Flowers.

NEWCASTLE-UPON-TYNE. — Royal Turk's Head Hotel. North East Electrical Club. "X-rays in the Medical World," by A. J. Wright.

SHEFFIELD.—Royal Victoria Station Hotel, 7.30 p.m. A.S.E.E. Sheffield Branch. "Electric Lifts and Controls," by C. Rhodes.

WAKEFIELD.—Strafford Arms Hotel, Bull Ring. Wakefield Association of Engineers. "Radar and its Applications," by R. T. Goode, followed by film, "Radar at Sea."

Tuesday, 5th January

EDINBURGH.—25, Charlotte Square, 7 p.m. Incorporated Plant Engineers, Edinburgh Branch. "Power Factor Correction," by H. Ferguson.

ELTHAM.—Congregational Church, Court Road, 8 p.m. A.S.E.E. South East London Branch. "Maintenance Problems."

HAMMERSMITH.—Windsor Castle Hotel, 134, King Street, 7.30 p.m. A.S.E.E. West London Branch. "Television Studio Planning," by H. C. Nichols.

LEEDS.—1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Centre. "Voltage Transformers and Current Transformers associated with Switchgear," by W. Gray and A. Wright.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurements Section. "A Scaling Unit Employing Multi-Electrode Cold-Cathode Tubes" and "A Sensitive Pulse Trigger Circuit with a Stable Threshold," by K. Kandiah. "The Development of a Neutron Spectrometer for the Intermediate Energies," by F. S. Goulding, J. C. Hammerton, M. G. Kelliher, A. W. Merrison and E. R. Wiblin.

At the Royal Society of Arts, John Adam Street, Adelphi, 7 p.m. Incorporated Plant Engineers, London Branch. "Transmission Equipment and Bearings," by F. J. Walters.

MANCHESTER.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Centre. "The Co-ordination of Insulation of High-Voltage Electrical Installations," by J. S. Cliff.

Wednesday, 6th January

BIRMINGHAM.—The University, Edgbaston, 10.30 a.m. Institute of Metals. Informal discussion on "Lubricants for Metal Working Operations in the Non-Ferrous Metal Industries."

EDINBURGH.—12, Rothesay Place, 7 p.m. I.E.S. Edinburgh Centre. "The Architect's Approach to Artificial Lighting," by R. G. Cox.

HARRINGAY.—"Queen's Head," 677, Green Lanes, N.4, 7.45 p.m. A.S.E.E. North London Branch. "Power Factor Correction." (Illustrated.)

HOVE.—S.E.E.B. Headquarters, 6.30 p.m. I.E.E. Southern Centre. "Operation of Power Transformers," by E. T. Norris.

LONDON.—At the Institution of Electrical Engineers, Savoy Place, W.C.2, 5 p.m. Institution of Post Office Electrical Engineers, London Centre. "Telex Service," by R. N. Renton.

London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1, 6.30 p.m. British Institution of Radio Engineers, London Section. "Some Factors in the Engineering Design of v.h.f. Multi-Channel Telephone Equipment," by W. T. Brown.

Film House, Wardour Street, 6.45 p.m. Television Society. "The Marconi Television O.B. Unit," by C. Carrington. (Joint meeting with the British Kinematograph Society.)

MANCHESTER.—Engineers' Club, Albert Square, 6.30 p.m. I.E.E. North-Western Radio Group. "A Simple Connection between Cloud-Loop Transient Response and Open-Loop Frequency Response," by Dr. J. C. West and J. Potts.

Central Library, 6.30 p.m. Manchester Metallurgical Society. "Recent Developments in Magnetic Materials," by A. E. De Barr.

MIDDLESBROUGH.—Cleveland Scientific and Technical Institute, 6.30 p.m. I.E.E. Tees-Side Sub-Centre. "Electrical Hazards and Electrical Safety," by D. A. Picken.

PRESTON. — 49a, Fishergate, 7.30 p.m. A.S.E.E. Preston Branch. "Miniature Circuit Breakers," by H. W. Wolff.

SWANSEA.—Y.M.C.A., 6.30 p.m. I.E.S. Swansea Group. "Flameproof Lighting Equipment for Hazardous Situations," by D. A. Strachan.

Thursday, 7th January

BRISTOL.—Electricity House. I.E.E. Bristol Students' Section. "Spark Discharge in Gases," by Dr. Grey Morgan.

CARDIFF.—Electricity Board's Demonstration Theatre, The Hayes, 5.45 p.m. I.E.S. Cardiff Centre. "Flameproof Lighting Equipment for Hazardous Situations," by D. A. Strachan.

CHELTENHAM.—Cadena Café, High Street, 6.30 p.m. I.E.S. Gloucester and Cheltenham Centre. Architects' night.

CROYDON.—Cafe Royal, North End, 8 p.m. A.S.E.E. South London Branch. "Water Heating," by R. Oldroyd.

EDINBURGH.—The University, 7 p.m. British Institution of Radio Engineers, Scottish Section, Edinburgh. "Radio Astronomy," by H. Seddon.

GLASGOW.—39, Elmbank Crescent, 6.30 p.m. I.E.S. Glasgow Centre. "Architect's Approach to Artificial Lighting," by R. G. Cox.

LIVERPOOL.—Electricity Service Centre, Whitechapel, 7 p.m. British Institution of Radio Engineers, Merseyside Section. "Interlacing Problems in Television Receivers," by Dr. G. N. Patchett.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. Institution of Electrical Engineers. Parsons Memorial Lecture. "Continuity of Electricity Supply," by H. Leyburn.

MANCHESTER.—College of Technology, 7 p.m. British Institution of Radio Engineers, North Western Section. "The Manchester University Computer," by D. B. G. Edwards.

NOTTINGHAM.—E.M.E.B., Smithy Row, 6 p.m. I.E.S. Nottingham Centre. "The Application of Fluorescent Dimming Circuits," by H. H. Ballin.

PETERBOROUGH. — Eastern Gas Board Theatre, Church Street, 7.30 p.m. Incorporated Plant Engineers, Peterborough Branch. "The Industrial Uses of Magnetic Power," by G. T. Hawker.

Thursday, 7th January, to Saturday, 9th January

LONDON.—King's College, Strand, W.C.2. Television Society. Annual exhibition.

National Hall, Olympia, W.14. National Exhibition of Cage Birds and Aquaria.

Friday, 8th January

BIRMINGHAM.—Midland Hotel. I.E.S. Birmingham Centre. Annual dinner.

LIVERPOOL.—9, The Temple, Dale Street, 7.30 p.m. A.S.E.E. Liverpool Branch. "Some Aspects of Motor Control Gear," by K. N. Swash.

LONDON.—Townsend House, Greycoat Place, 7 p.m. Junior Institution of Engineers. "A Modern Vehicle Actuated Detector and its Development," by H. J. N. Riddle.

Feathers Hotel, Broadway, S.W.1, 6 p.m. Electrical Trades' Commercial Travellers' Association. General meeting.

MANCHESTER.—Engineers' Club, Albert Square, 6.45 p.m. Manchester Association of Engineers. Discussion on "Training of Designer-Draughtsmen."

NEWCASTLE-ON-TYNE.—Grand Hotel, Barras Bridge, 6.30 p.m. I.E.E. North Eastern Students' Section, Tyneside meeting. Problems night, led by the Centre chairman.

STOKE-ON-TRENT.—Copeland Arms Hotel. 7.30 p.m. A.S.E.E. Stoke & Crewe Branch, "Industrial Lighting," by P. Corry. (Illustrated.)

New Atomic Plant

WE are informed that Taylor Woodrow Construction, Ltd., London, are the building and civil engineering contractors for the thermal reactor, from which power from atomic energy will be produced in industrial quantities, at Calder Hall, Cumberland. The building construction work, which is under the direction of Sir Charles Mole, Director General of Works, Ministry of Works, began in August and will take three years to complete.

Mr. Lloyd, Minister of Fuel and Power, told the House of Commons on 26th October that it was expected that the new station at Calder Hall, together with a breeder reactor (for which a site has still to be chosen), would result in 50,000 kW becoming available.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia. — GRAFTON, N.S.W. — 8th January. Fifteen 11,400 V oil circuit breakers. (E.S.B. 11734/53. Ten/7807.)*

One 90,000 lb/hr boiler complete with auxiliaries and accessories for the Northern Rivers County Council. (E.S.B. 11733/53. Ten/7841.)*

Ballymena.—11th January. Northern Ireland Hospital Authority. Complete installation of electrical services at Waveney Hospital. Authority's chief engineer, Victory Buildings, 44-46, Queen Street, Belfast.

Belfast.—5th March. Electricity Department. Boiler plant. (See this issue.)

Burntisland.—15th January. Corporation. Street lighting equipment. (See this issue.)

Camberwell.—8th January. Borough Council. Electric lamps for one or three years from 1st April next. Borough surveyor, Town Hall, S.E.5.

Denmark. — COPENHAGEN. — 7th January. Invalideforsikringsretten. Hearing aids. (E.S.B. 6855/53. Ten/7859.)*

Donaghadee, Co. Down—14th January. County Education Committee. Electrical installation in the new school meals centre, Killaughey Road. Forms from A. N. Irens, consulting engineer, Friends' Provident Building, 58, Howard Street, Belfast.

Donegal.—3rd February. County Council. Electrical installation in connection with a new district hospital at Dungloe. J. C. Costello, consulting engineer, 21, Leeson Park, Dublin.

Egypt. — CAIRO. — 26th January. Director General, Cairo Electricity and Gas Administration. 11 kV overhead lines, substations, etc. (See this issue.)

Fareham.—20th January. U.D.C. Electrical fittings and lamps for one year. Surveyor, Westbury Manor, West Street.

Glendale (Northumberland). — 4th January. R.D.C. Electrical wiring of Council offices to be built at Wooler. Surveyor, Wooler.

India. — MYSORE. — 4th January. Government Stores Purchase Committee. Porcelain bushings. (E.S.B. 12171/53. Ten/7823.)*

MADRAS.—6th January. Department of Electricity. 12,000 a.c. meters. (E.S.B. 12438/53. Ten/7849.)*

NEW DELHI.—20th January. Director General of Supplies and Disposals. Insulated cables. (E.S.B. 11863/53. Ten/7794.)*

Lebanon.—BEIRUT.—M. Ezzat Jollad & Fils, 32, Rue Patriarche, Hayek. Two 3,500 to 4,000 kW steam turbine generating plants or alternatively four diesel elecrtic sets having a total output of 7,000 or 8,000 kW. (E.S.B. 12465/53. Ten/7854.)*

New Zealand.—WELLINGTON.—18th February. Post Office. Telephone terminal block covers. (E.S.B. 12136/53. Ten/7818.)*

North Cotswold.—1st February. R.D.C. Electrically driven, vertical spindle, centrifugal pumps and auxiliary equipment for Moreton-in-Marsh sewage disposal scheme. John H. Haiste & Partners, Norwich Union Chambers, Clarence Street, Gloucester.

Pakistan.—KARACHI.—26th January. Department of Supply and Development. Three 1,500 kW diesel generating sets, water cooler, water softening plant and air compressor. (E.S.B. 12011/53. Ten/7792.)*

Plymouth.—16th January. Water Department. Power cable. (See this issue.)

Skelton and Brotton (Yorks).—6th January. U.D.C. Wiring of 16 houses, Brotton Estate. Plans by the Surveyor, Council Offices, Skelton-in-Cleveland.

South Africa.—CAPE TOWN.—15th January. Provincial Administration of the Cape of Good Hope. Combined faradic, galvanic and sinosoidal generator. (E.S.B. 12472/53. Ten/7865.)*

JOHANNESBURG.—18th January. City Treasurer's Department. Pilot and telephone cable and accessories. (E.S.B. 12406/53. Ten/7830.)*

PRETORIA.—14th January. Union Tender and Supplies Board. Radio test instruments. (E.S.B. 12116/53. Ten/7847.)*

Southern Rhodesia. — SALISBURY. — 8th January. Department of Posts and Telegraphs. Steel tubular telephone poles. (E.S.B. 12634/53. Ten/7871.)*

12th February. Automatic telephone exchanges. (E.S.B. 12635/53. Ten/7874.)*

8th January. Southern Rhodesia Tender Board. Deep X-ray therapy units. (E.S.B. 12636/53. Ten/7867.)*

BULAWAYO.—19th January. Town Council. Tubular steel poles, electrical equipment and accessories. (E.S.B. 12102/53. Ten/7828.)*

UMTALI.—27th January. Electricity Department. L.v. cable. (E.S.B. 11895/53. Ten/7800.)* Four 500 kVA and four 300 kVA transformers. (E.S.B. 11893/53. Ten/7799.)* H.v., d.c. testing equipment and triple pole contactor gear. (E.S.B. 11894/53. Ten/7801.)*

Tangier.—29th January. Tangier Electricity and Water Board. Electrical equipment for transformer station. (E.S.B. 11272/53. Ten/7810.)*

United States.—PORTLAND, OREGON.—Corps of Engineers. Two 14,210 kVA fish channel water supply generators for Dalles Dam power station. (E.S.B. 12245/53. Ten/7843.)*

DENVER, COLORADO.—12th January. Bureau of Reclamation. Main control and distribution boards and battery charger. (E.S.B. 12214/53. Ten/7855.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1. (Chancery 4411; extension 769).

ORDERS PLACED

Cockermouth.—U.D.C. Accepted. Installing electric lighting in Station Road, Lamplugh Road, Market Place, St. Helen's Street, Waste Lane and Mayo Street (£2,087).—Revo Electric Co., Ltd.

Hazel Grove.—Cheshire County Council. Accepted. Electrical installation at Secondary Modern School.—Cohen Bros. (Electrical), Ltd.

London.—County Council. Electrical installation works at the Torridon Primary School, Lewisham (£4,030).—Thorpe & Thorpe, Ltd.

Luton.—Corporation Committee for Education. Recommended. Electrical installation at the Ramridge Junior School (£2,347).—David Thomson & Sons (London).

Middlesbrough. — Town Council. Electrical services, wiring and time switches in connection with street lighting improvements in Newport Road and Corporation Road (£1,140).—North Eastern Electricity Board.

Romford. — Corporation. Recommended. Street lighting in Straight Road (£1,201).—Revo Electric Co.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Banstead.—Civil defence headquarters and machine room at Council House for U.D.C.; F. L. Shaw, clerk, Council House, Brighton Road, Banstead, Surrey.

Belfast.—Food factory in Prince Regent Road; Belfast Food Products, Ltd., Castlereagh.

Bexhill-on-Sea.—Convalescent home, Terminus Avenue, for Hearts of Oak Benefit Society; local secretary.

Birmingham. — Factory premises, Ruston Street; city architect.

Extensions and alterations to St. Paul's Grammar School, Edgbaston (£38,000), for R.C. authorities; Very Rev. P. Lynch, Superior of the Oratory.

Bracknell.—Factory for Corrugated Wrappers, Ltd.; Architect's Dept., Bracknell Development Corporation, Farley Hall, Binfield.

Brighton.—Factory, Lower Bevendean, for Harrimonde, Ltd.; town clerk.

Factory, Lower Bevendean; S. & G.